



# Extreme Plants Traveling Sideshow

PROGRAM EVALUATION

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## Executive Summary

The Extreme Plants Traveling Sideshow is a theatre piece performed at the Natural History Museum of Utah in relation to the special exhibition, The Power of Poison. While NHMU has a history of Museum Theatre performances, this was the first to be performed since its move to the Rio Tinto Center.

The goal of this evaluation was to understand the visitor experience with museum theater and museum theatre's value in communicating science content, as well as to inform future productions at NHMU. With this in mind, we sought answer the following questions:

1. Did guests feel the performance added value to their museum visit?
2. Did guests find the performance engaging?
3. Do guests report an awareness of the four main ideas?

To answer these questions, Kari Ross Nelson, in collaboration with Paul Michael Maxfield, created two protocols: a child interview and an adult survey. 16 children were interviewed and 42 adults completed the survey.

Findings from both protocols suggest that the performance was engaging and added value to the subjects' museum visit. Three of the four main ideas the producers hoped to convey were evidenced either explicitly or implicitly.

## Background

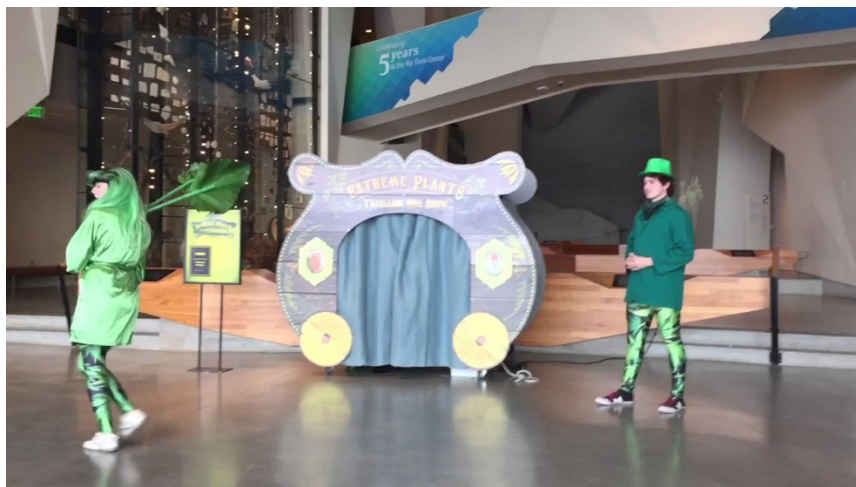
The Extreme Plants Traveling Sideshow is a theatre piece performed at the Natural History Museum of Utah in relation to the special exhibition, The Power of Poison. The piece was produced in partnership with Dr. Phyllis Coley, a University of Utah researcher who explores the world's rainforests studying the co-evolution of tropical plants and insects. NHMU and Dr. Coley's Lab aimed to convey four main ideas through the Extreme Plants Traveling Sideshow: 1) Plants are not helpless vegetables; 2) Plants have evolved an astounding battery of defense to protect themselves against their predators; 3) Plants and insects have been co-evolving for millions of years; 4) many of today's medicine come from the chemical defenses plants use to protect themselves.

The Extreme Plants Traveling Sideshow features five characters, played by two actors. Performance took place on Tuesdays and Saturdays from Nov 1 to April 15 in the Canyon at the Natural History Museum of Utah, with each performance running approximately 15 minutes.

## Evaluation Questions

The goal of this evaluation was to help NHMU decide if it should continue to invest in museum theatre. With this in mind, we sought answer the following questions:

4. Did guests feel the performance added value to their museum visit?
5. Did guests find the performance engaging?
6. Do guests report an awareness of the four main ideas?



## Methodology

Adults and children were the audiences of primary interest to the producers of this play. Two protocols were developed to ascertain the impression the performance had on these two groups in relation to the evaluation questions.

A 20-item survey was developed for adult visitors. Items explored how they found out about the performance, prior knowledge and self-reported changes to it, affective qualities including enjoyment and interest, and finally demographic information. See Appendix 1 for the full survey. Surveys were distributed to a convenience sample after each of the two performances on four different Saturdays in March and April, 2017. The original goal was to collect 50 surveys. Only 42 surveys were collected, nevertheless, clear patterns emerged in the analysis.

A semi-structured interview was developed for child visitors aged 5-12 years old. Children were invited to rate their enjoyment, and then explain why they chose that rating. They were asked to share something they felt they learned, and to recall information about each character in the play. See Appendix 2 for the full interview protocol. Interviewers approached families who arrived prior to the start of the performance, and asked parents if they would allow their children speak to the interviewers for a few minutes after the performance. 4-5 children were recruited before each performance and invited to join the two interviewers at a table in the NHMU Canyon after. The original goal was to conduct 15 interviews. A total of 16 were conducted after each of the two performances on two different Saturdays during March 2017.

Both instruments were created with the underlying approach of exploring awareness, knowledge, or understanding according to the impact categories defined in the document *Framework for Evaluating Impacts of Informal Science Education Projects: Report from a National Science Foundation Workshop* (available at <http://www.informalscience.org/framework-evaluating-impacts-informal-science-education-projects>). The authors of that report generally define awareness, knowledge, or understanding as “measurable demonstration of assessment of, change in, or exercise of awareness, knowledge, understanding of a particular scientific topic, concept, phenomena, theory, or careers central to a project.” Evidence for this impact is described as:

“...changes in participants’ knowledge (directly assessed or self-reported), as well as observed cognitive activities such as reinforcing prior knowledge, making inferences, or building an experiential basis for future learning (though this is more difficult to assess). It also includes memory of an experience over time, especially aspects of the experience that relate to STEM concepts, processes, or activities. Participants’ reflections and monitoring of their own learning also falls into this category.”

(p. 22)

The instruments were designed to solicit responses that could demonstrate these types of evidence, or a lack thereof.

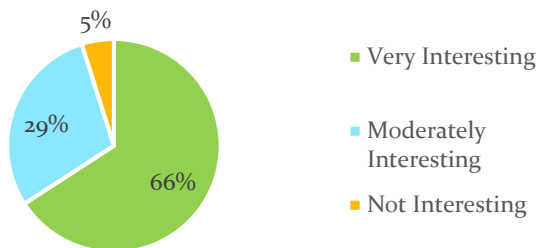
Internal Review Board (IRB) approval was sought as part of the evaluation planning process. The IRB Office at the University of Utah found the project exempt, classifying it as evaluation for the purpose of program improvement.

While there were multiple casts throughout the show’s run at NHMU, the same actors appeared in each performance during which evaluation data was collected.

## Results: Adult Surveys

66% of subjects (27) reported finding the performance very interesting, while 29% (12) found the performance moderately interesting. As a follow up, subjects were asked what they found interesting. Responses from both groups were similar, citing the enthusiasm of the actors and facts about plant defenses and their role in medicines as what they found most interesting.

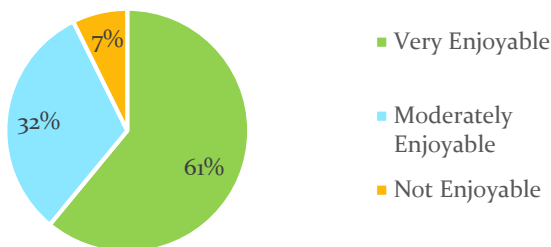
### How Interesting Did you Find This Performance?



“They were very energetic and loved the "pants" :)! Still love the toxins made by plants that in small doses can actually have healing properties. It astounds me.”

Responses to the question “How enjoyable did you find this performance?” were similar to item above, with 25 (61%) rating it as very enjoyable, and 13 (32%) as moderately enjoyable. Again, both groups responded similarly to the follow up question about what made it enjoyable, with most referring to the fun and energetic performance of the actors.

### How Enjoyable Did You Find This Performance?



## Demographics

Sample Size: n=42

8 (19%) in their 20s, 13 (31%) in their 30s, 26 (62%) in their 40s, and the remaining 6 (14%) in their 50s, 60s, or 70+.

Average Group Size: 5  
(Outliers removed)

33 (79%) were visiting with children.

15 (36%) were first time visitors.

8 (19%) were members of NHMU.

24 (57%) listed Utah zip codes. Other listed zip codes from Hawaii, California, Oregon, Washington, Idaho, Wyoming, Texas, Missouri, and Maryland.

One subject did not respond to every of the items, thus some responses will sum to just 41.

Three subjects knew about the performance before coming to the Museum, and two said it was their reason for coming. All others learned about it from the ticket desk, the signs, or just from happening upon it.

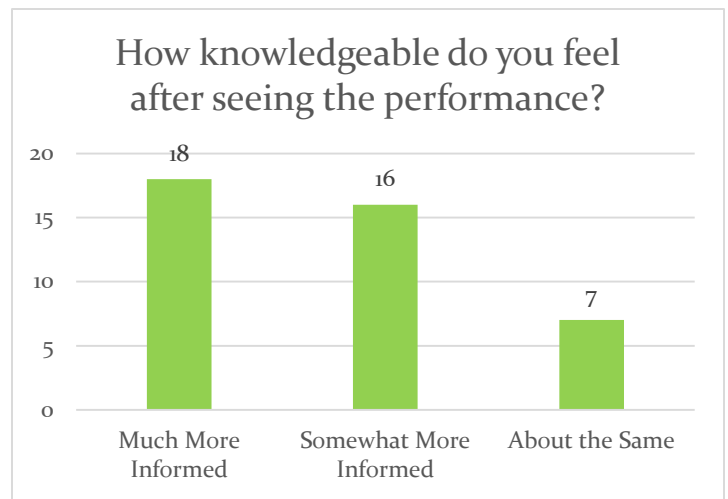
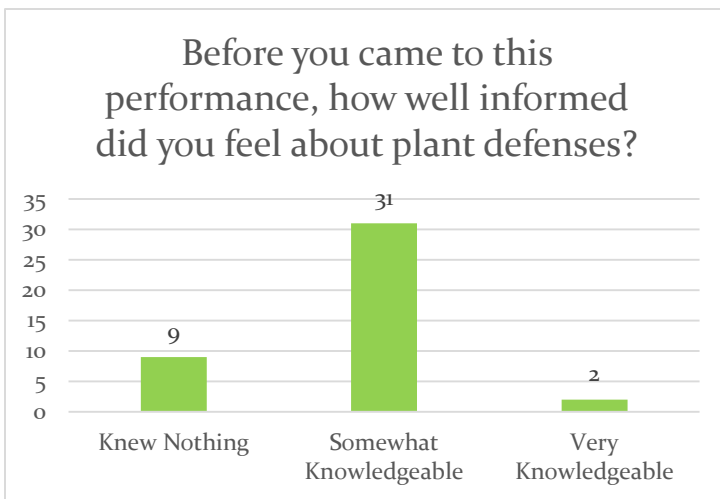
“Performer's energy and enthusiasm.”

“The way to incorporate info with performance.”

Subjects were asked to report their knowledge of plant defenses before the performance, and then how compare that to how much more informed they felt after it.

Before the performance, most (31, or 74%) felt somewhat knowledgeable about plant defenses. After the performance, 18 (43%) felt much more informed, and 16 (38%) felt somewhat more informed.

3 of the nine subjects who reported they knew nothing before, felt they were much more knowledgeable after the performance and the other six felt somewhat more informed.



When asked what was one new idea they were taking away with them, nine subjects did not respond. The remaining 33 responses fit into three response types: plant defenses, medicines and other benefits to humans, and miscellaneous responses.

Examples:

Plant defenses (13 responses)

- “So many ways plants defend themselves.”
- “Caterpillars eat plants, and ants keep them away.”

Medicines and other benefits to humans (10 responses)

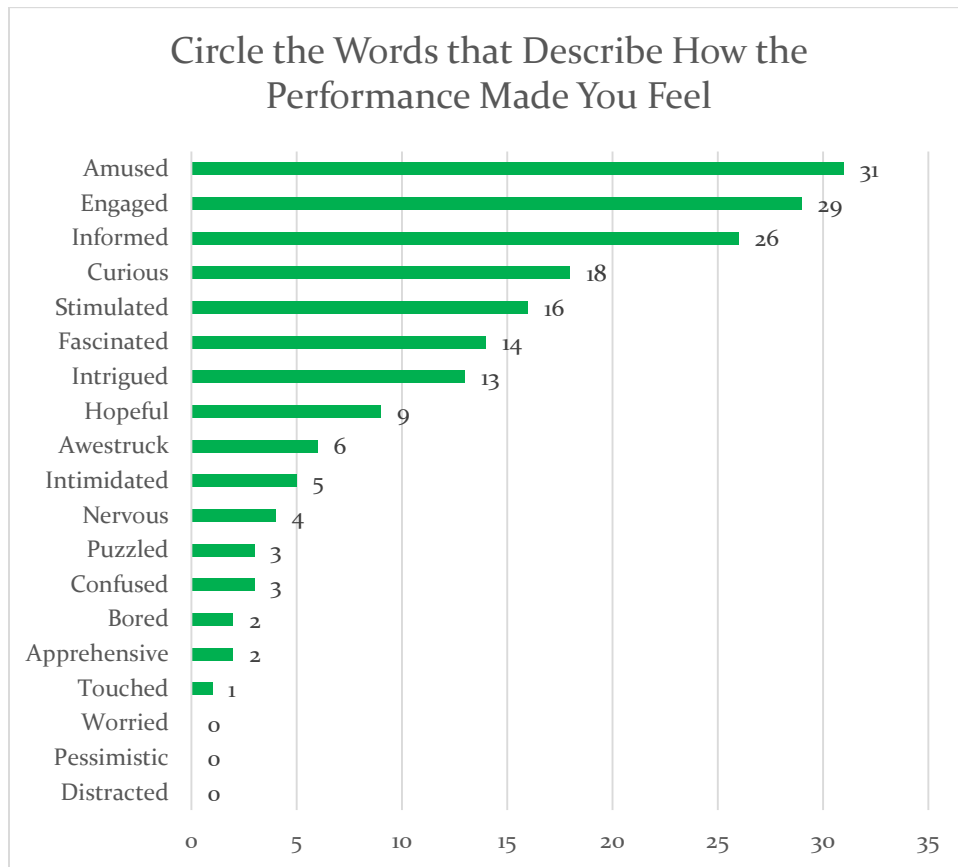
- “Many plants help us by being able to create medicine.”
- “That more of our modern world is attributed to natural occurrences (sic) than man made solutions.”

Miscellaneous (10 responses)

- “Actress has a great voice. Let her sing more.”
- “How to engage kids in science through theater.”

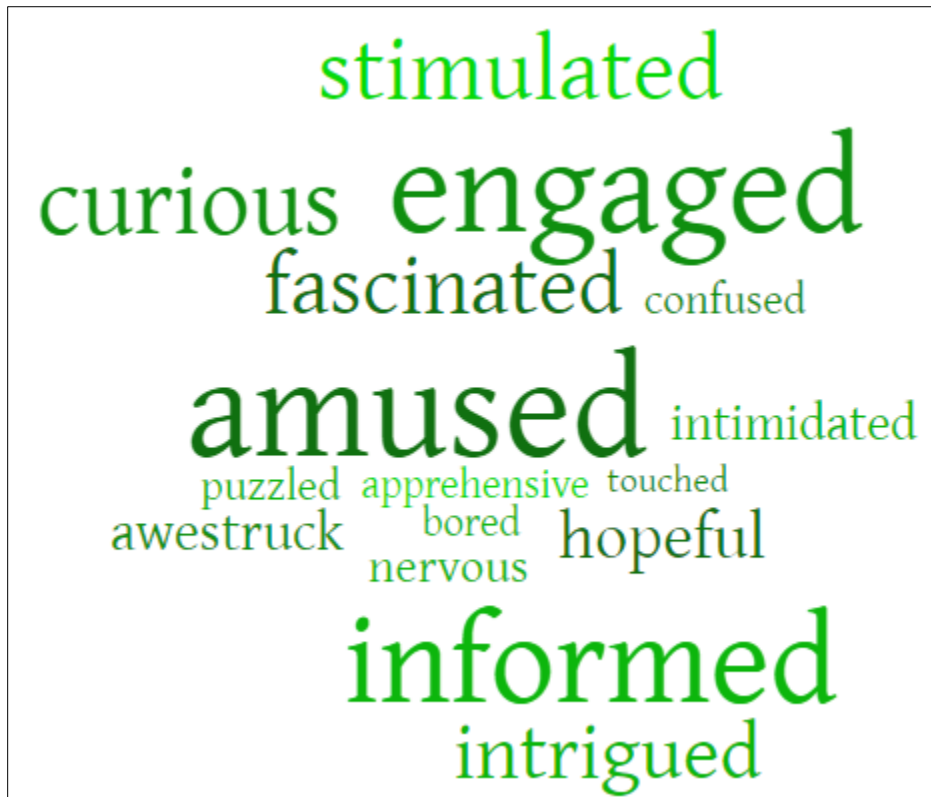
Two items on the adult survey sought to ascertain affective characteristics of the subjects' experiences with the performance. The first item asked if they were surprised by any of the content in the performance. For analysis purposes, if the item was left blank, it was coded as "no." Responses to this item were nearly evenly split, with 20 (48%) responding yes, and 22 (52%) responding no. A few subjects who responded "yes" also volunteered what surprised them, examples include "ants," "exoskeletons," "medicines," "singing" and "tights."

The second item presented subjects with a word bank and asked them to circle the words which described how the performance made them feel. The most commonly circled words were amused (31), engaged (29), and Informed (26). Four words from the list that were not selected were worried, pessimistic, and distracted.





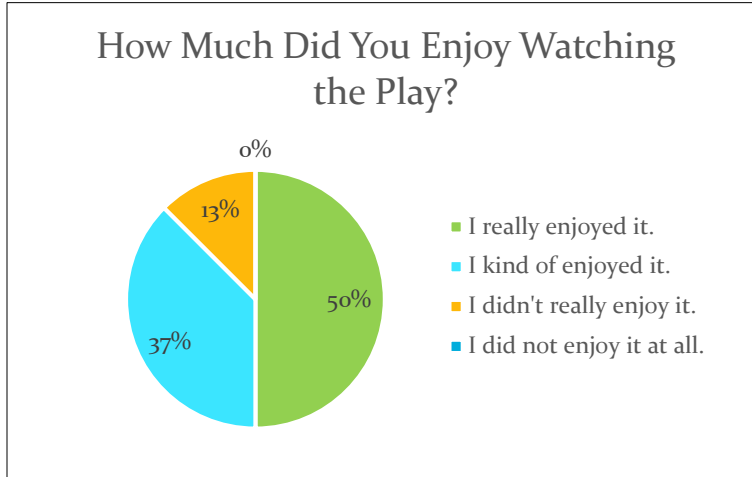
Another way to visualize this data is with a word cloud. The word cloud below includes each of the words selected, with the more frequently selected words appearing larger, and the less frequently selected words appearing smaller.



Finally, subjects were asked if they would attend this kind of performance if it they knew it were happening next time they visited NHMU, and if they felt it added value to their visit. Visitors responded overwhelmingly in the positive: 35 (83%) said they would attend this kind of performance again, and 37 (88%) felt viewing the performance added value to their visit to the Museum that day.

## Results: Child Interviews

Half of the 16 children interviewed (8, or 50%) reported really enjoying the play, while 6 (37%) said they kind of enjoyed it. 2 (13%) said they didn't really enjoy it and none said that they did not enjoy it at all.



## Demographics

Sample Size: n=16

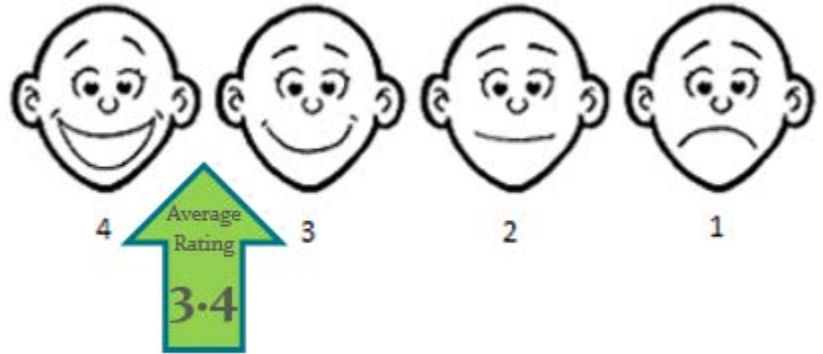
9 girls and 7 boys were interviewed.

Age was not collected for individual subjects, but we explained to parents we wanted to speak with children between 5 and 13 years old. We can assume all subjects were in that age range.

A numeric value was assigned to each rating to calculate an overall average.

- I really enjoyed it = 4
- I kind of enjoyed it = 3
- I didn't really enjoy it = 2
- I did not enjoy it at all = 1

The average rating was 3.4.



Each subject was asked to explain why they selected the rating they did. Only one could not articulate the reason for her selection. Other responses related to the show being funny (4), learning (3), the characters and their enthusiasm (3), and interesting content (2). Two subjects rated the performance a 3, but responded that the performance was "weird" because of "the yelling" and that she "couldn't really understand the girl's voice."

Children were next asked to share one new thing they learned from the play. 11 (69%) of the subjects were able to articulate a new idea, with all but one related to plant defenses. The remaining subject referenced the Nobel Prize awarded for medical research involving plants.

Examples:

- “Different plants use different poisons. And like the hairs get into the caterpillar and it makes more sweet stuff for the ants, they're like body guards. The names, I don't really remember them now. They were weird names.”
- “That the Nobel Prize was given because of a chemical found in a plant that would help.”

Finally, children were shown images of the characters in the play and asked if they remembered them, and what they remembered about them. All but one child recalled each character, but not all remembered specific content about them. Notably, descriptions of the character Ingebelle most frequently included specific content. The complete transcript of responses to this prompt are included as Appendix 3 of this document.

Narrator

- “I remember him talking about plants. Funny.”
- “He's basically the director who tells you about it. At the very start of the show, he said that plants and herbivores have been battling for 350 million years.”
- (*Appears to be thinking, has trouble coming up with something.*) “He talked really fast.”

Strong Plant

- “She was acting like she was really strong and she was singing a song about being really strong.” (*When probed, subject couldn't remember what makes her strong.*)
- “She told about what defenses she has and what it does to the caterpillars. Strong plant. The hairs go into their body and it destroys their insides.”
- “Creepy.”

Ingebelle

- “It was the one that would, like, have ants distract the enemy.”
- “She was the one who fed the ants for them to protect her from caterpillars and different bugs.”
- “She rewards ants with her nectar because they protect her.”

Twins

- “They obsessed with making new toxins to kill bugs that tried to eat their leaves. So if the bugs eat them they'd get a really bad toxin in them and something bad could happen.”
- “They were like fighting and like stuff. And getting angry at each other.” (*Didn't remember what they were fighting about.*)
- “They like to make poisons.” (*What do they do with the poisons?*) “They use them on insects, to kill them.”

Further analysis of the data suggested an unusual pattern: children who rated their overall enjoyment as 3 (I kind of enjoyed it), recalled specific content conveyed by the characters 71% of the time, while children who rated overall enjoyment at 4 (I really enjoyed it), recalled specific content just 31% of the time. While the sample size was not large enough to examine the correlation statistically, it is an interesting phenomenon to consider.

### NEGATIVE CASES

While responses to both the adult surveys and the child interviews were primarily positive indications of enjoyment and learning, there were the occasional negative responses that should not be overlooked.

One child rated her enjoyment of the performance as 2 (I didn't really enjoy it), and said it was hard for her to understand what they were saying. Another commented that the characters talked too fast. Two adults volunteered similar comments in the available space at the end of the paper surveys:

“The performance looked terrific. The performers had great costumes, were animated, etc. etc. However, the sound system was such that I have absolutely no idea what was going on. It was way too loud, loud enough that we couldn't understand what the performers were saying. I would very much like to see it again with no sound system - I think I would have heard and understood them just fine, and it would have been terrific! Thanks! :)”

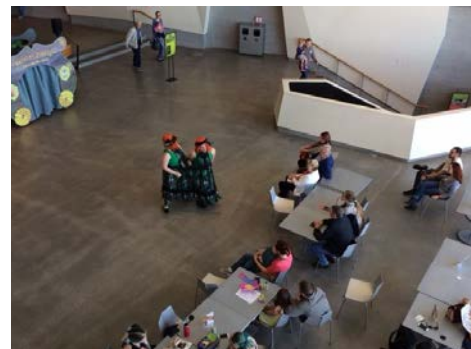
“The volume was much too loud. If the performers had not been wearing microphones (especially for the space) it would have been much more enjoyable without the microphones, we could have heard also I think the performers were speaking much too fast for many people, especially children to understand the context.”

Another child who rated his enjoyment as 3 (I kind of enjoyed it), explained that rating by saying the performance was “a little weird. When asked what made it weird, he responded, “Mostly the yelling.” This is similar to one adult visitor who spoke with one of the data collectors as he returned his survey. He had a mild disposition as he expressed his feeling that the play was negative and obnoxious. He did not doubt the talent of the actors, but they (he and his partner) are trying to expose their children “to positive music and other things,” and he felt this was not positive.

It is also worth noting that in the adult survey item asking visitors to select words that described how the performance made them feel, words with negative connotation were occasionally selected: apprehensive, bored, confused, intimidated, nervous, and puzzled. (See page 7 for a full discussion of this item.)

### ANECDOTAL OBSERVATIONS

Throughout the duration of each performance where data was collected, visitors were observed to be engaged with the program – focusing on the action, smiling, laughing, and applauding appropriately. Additionally, visitors could be seen watching each performance from open landings on upper floors of the Museum.



## Discussion of Evaluation Questions

This section will revisit the evaluation questions stated at the beginning of this report, and seek to answer them based on the data and findings presented in the previous sections.

### 1. Did guests feel the performance added value to their museum visit?

Yes. Adult guests were asked in the survey if they felt the performance added value to their museum visit. 37 (88%) of the 42 subjects responded “yes.” As validation of this sentiment, 35 (83%) responded that they would attend this kind of performance again if they knew it was happening next time they visited NHMU. While museum visitors often come as a leisure time experience, they choose to come to a museum to learn as part of that experience. Two visitors made comments that suggest they experienced this blend of leisure and learning:

*What was most enjoyable to you?*

- “The way to incorporate info with performance”
- “The fun way the information was presented :!”

### 2. Did guests find the performance engaging?

Yes. When selecting from a bank of 19 words to describe how they felt during the performance, guests most frequently chose words that communicate engagement: engaged, amused, curious, and stimulated. The word bored was selected only once, and the word distracted not at all. Additionally, audiences were observed to be focused on the performances, smiling, clapping, and laughing at expected points in the dialogue.

### 3. Do guests report an awareness of the four main ideas?

The producers of Extreme Plants Traveling Sideshow intended to communicate four main ideas to the audience: 1) Plants are not helpless vegetables; 2) Plants have evolved an astounding battery of defense to protect themselves against their predators; 3) Plants and insects have been co-evolving for millions of years; 4) many of today's medicine come from the chemical defenses plants use to protect themselves.

Responses to open-ended items on the adult survey show evidence of subjects' awareness of all but the third idea, *plants and insects have been co-evolving for millions of years*. Responses related to plant defenses were most common, followed by responses related to use of plants in medicines. Findings in child interviews were similar. Though the first idea, *plants are not helpless vegetables*, was only mentioned specifically twice during the child interviews, it was implied in many responses related to plant defenses in both surveys and interviews.

Finally, in the adult survey, 81% reported feeling much more informed or somewhat more informed about plant defenses than before the performance – suggesting they learned something new from it.

## Conclusion

Museum theatre is an interpretive tool used by many museums to share exhibitions in an engaging and novel way. While NHMU has a history of productions, Extreme Plants Travelling Sideshow was the first since its move to the Rio Tinto Center. The goal of this evaluation was to understand the visitor experience with museum theater and museum theatre's value in communicating science content, as well as to inform future productions at NHMU.

Adult visitors who viewed the EPTS performances found the production interesting, enjoyable, and informative. They also reported that it added value to their Museum visit. Children who viewed the performances likewise found it enjoyable and most were able to recall the characters and some of the content conveyed by the characters. Negative responses generally related to the sound quality and the actors' fast pace of speaking.

Considering these findings in discussion with primary stakeholders, NHMU should feel confident in proceeding with future theatre pieces to complement the interpretive strategies of its exhibitions and mission. In this case, it was found to be a useful way to communicate science related *The Power of Poison* exhibition.

## SUGGESTIONS FOR FUTURE EVALUATIONS

- Increase sample size, particularly in adult survey, to increase validity of findings and allow for statistical comparisons.
- Train interviewers more intentionally in interview skills, particularly the nuances of working with children, to avoid biasing of "feeding" responses.
- In an adult survey add a follow up question after "Were you surprised by any of the content?", to allow visitors to expound on what surprised them, as well as the prompt: "Anything else?" at the conclusion for spontaneous, unanticipated responses.

## Appendix 1: Adult survey instrument.

### NHMU Program Evaluation: Extreme Plants Travelling Sideshow

1. How did you hear about the Extreme Plants Travelling Sideshow performance today?
2. Did you know before coming to NHMU today that this performance was taking place?  
 Yes  
 No

If yes, was the performance one of your reasons for coming today?

3. Before you came to this performance, how well-informed did you feel about plant defenses?  
 Very Knowledgeable  
 Somewhat Knowledgeable  
 Knew Nothing

If you responded Very Knowledgeable, please explain:

4. How knowledgeable do you feel after seeing the performance?  
 Much more informed  
 Somewhat more informed  
 About the same
5. What is one new idea you are taking away with you after seeing the performance?
6. Were you surprised by any of the content?
7. How interesting did you find the performance?  
 Very interesting  
 Moderately Interesting  
 Not Interesting

8. What was the most interesting aspect to you?

9. How enjoyable did you find the performance?

- Very Enjoyable
- Moderately Enjoyable
- Not enjoyable

10. What was the most enjoyable aspect to you?

11. Please circle all the words below that describe how the performance made you feel.

- |             |            |              |            |           |
|-------------|------------|--------------|------------|-----------|
| Informed    | Engaged    | Worried      | Curious    | Bored     |
| Pessimistic | Stimulated | Touched      | Puzzled    | Confused  |
| Hopeful     | Nervous    | Amused       | Fascinated | Awestruck |
| Intimidated | Distracted | Apprehensive | Intrigued  |           |

12. What did you think about the length of the performance?

- Way too long
- Too long
- About right
- Could have been a little longer
- Could have been a lot longer

13. Would you attend this kind of performance again if you knew it was happening next time you visited NHMU?

- Yes
- No

14. Overall, do you feel viewing the performance of EPTS added value to your visit to NHMU today?

- Yes
- No



Please circle the age group would you put yourself in.

20s   30s   40s   50s   60s   70s+

How many people are in your group today?

Are you visiting today with children, or adults only?

- With children
- Adults only

Is this your first visit to NHMU?

- Yes
- No

Are you a member of NHMU?

- Yes
- No

What is your zip code? Or, if you are visiting from outside of the US, what country do you live in?

## Appendix 2: Child interview protocol.

### NHMU Museum Theatre Evaluation Study

#### Child Interview Protocol

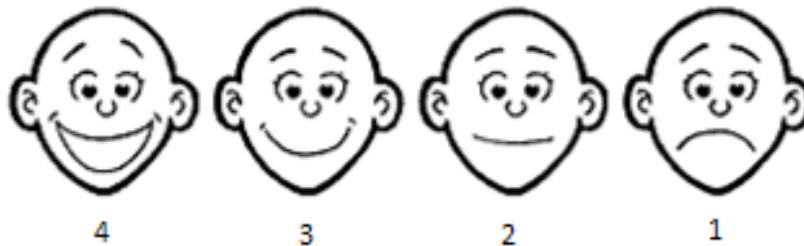
How much did you enjoy watching the play?

4: I really enjoyed it

3: I kind of enjoyed it

2: I didn't really enjoy it

1: I did not enjoy it at all



Why did you  
choose that face?

What is one new thing you learned about in the play?

*(Show images of characters in costume and ask the following, recording responses.)*

Which of these characters do you remember seeing in the play? What do you remember about them?



### Appendix 3: Interview responses related to recall of characters.

Which of these characters do you remember seeing?	What do you remember about them?
Inge	She helped things. She was kind of like a tree.
Inge	She was super sweet. Ants like her.
Inge	She sort of singed. Um, like how the ants eat the caterpillars
Inge	It was the one that would like have ants distract the enemy.
Inge	Uses nectar to make ants - to like protect it against caterpillars.
Inge	She was kind of like singing a little song, like, something. (Couldn't remember what song was about.)
Inge	She's a plant. (could not remember what she did.)
Inge	She was the one who fed the ants for them to protect her from caterpillars and different bugs.
Inge	She likes to sing. She can protect herself. (Lora probes: do you remember how she protects herself? The child does not remember.)
Inge	Weird.
Inge	Attractive. (Kathy asks how it's attractive. He says "pollen." She repeats to confirm.) Some animals eat and drink pollen.
Inge	She hired ants to kill all the caterpillars so they wouldn't eat her leaves.
Inge	Remembers, but not what they talked about.
Inge	She rewards ants with her nectar because they protect her.
Inge	She has like an ant army sort of.

Narrator	He was the first one to come out. He talked about plants.
Narrator	He was the one who introduced all the plants. He was the first actor.
Narrator	This was kind of like the introduction person.
Narrator	He was like the main actor guy who was like, well not actor, he was kind of like the introducer. He was talking all about that, if he like asks people if he scares them. (Kathy asks the subject if he got scared. Sounds like he snickers and says "no.")
Narrator	He was like the main actor who told about the people before they came out.
Narrator	That guys like the narrator and stuff. He talked about like, were you scared about the plants he was going to show you and stuff.
Narrator	He was who announced how much time to the play and who at the beginning would name and tell us stuff, like the names of the poisons.
Narrator	He is an actress. That plants don't just sit there and let people eat them.
Narrator	I remember him talking about plants. Funny.
Narrator	Funny.
Narrator	He's basically the director who tells you about it. At the very start of the show, he said that plants and herbivores have been battling for 350 million years.
Narrator	Yelling.
Narrator	He was funny. (He talked about) plants.
Narrator	(Has trouble thinking of something.) He talked really fast.
Narrator and Strong Plant	They yell.

Strong Pla	She was acting like she was really strong and she was singing a song about being really strong. (couldn't remember what makes her strong.)
Strong Plant	Remembers, but not what they talked about.
Strong Plant	She was the deadliest, she was the second one.
Strong Plant	She was the strong plant. She was super deadly.
Strong Plant	(Recognized image, but didn't seem to recall anything)
Strong Plant	Like the strong plant. (What do you remember about Strong Plant?) Not too much.
Strong Plant	(spends quite a bit of time looking at pictures and saying Umm... Before choosing strong plant.) This one has tiny hairs on it. She uses them to kill caterpillars. (When asked if she remembered the other characters and if she learned anything about them, she said no.)
Strong Plant	I liked the strong plant. He was kind of like uses different defenses against things that tried to eat it.
Strong Plant	She told about what defenses she has and what it does to the caterpillars. Strong plant. The hairs go into their body and it destroys their insides. (Sounds like she's kind of mean!) Uh huh, to caterpillars! (Would you want to meet her in your back yard?) It depends on what she'll do to me!
Strong Plant	She is super strong.
Strong Plant	Creepy.
Strong Plant	Strong. Spikes.
Strong Plant	Basically obsessed with killing bugs.
Strong Plant	I don't know.
Strong Plant	She's a strong plant and she has little hairs on her.

Twins	They were trees. They were the deadliest. I liked the last one.
Twins	They liked poison. They were twins. They talked about poison.
Twins	They give, like, poison to other plants.
Twins	They poison, they like, know a ton about - they use poisons to like protect themselves.
Twins	They like poisons and toxins.
Twins	They were like fighting and like stuff. And getting angry at each other. (didn't remember what they were fighting about.)
Twins	They wear the same clothes.
Twins	They were twins. They were the ones who used poisons. (What did they use it for?) Killing bugs.
Twins	They are twins and they like to boss each other around.
Twins	Crazy.
Twins	Poisonous. Toxins and poisons.
Twins	They obsessed with making new toxins to kill bugs that tried to eat their leaves. So if the bugs eat them they'd get a really bad toxin in them and something bad could happen.
Twins	(Long pause. Kari asks "do you remember things they talked about?" Mom tries to prompt, but still doesn't talk.)
Twins	They like to make poisons. (What do they do with the poisons?) They use them on insects, to kill them.
Twins	I just remember that these were the poison twins. (Do you remember any of the things they talked about?) No.