Evolved: An Exhibition on Human Evolution Formative Evaluation Research Protocol

I. Objectives

The purpose of this research study is to understand museum visitor's reactions to and learning outcomes from the exhibition Evolved and to utilize that information to inform and further improve the design of the exhibition.

This evaluation aims to:

- Determine how and if visitors interact with the exhibition activities and concepts
- Determine if visitors enjoy learning about human evolution as an informal learning experiences
- Determine what visitors gain from the exhibition, whether in terms of formal learning objectives or less strictly defined outlooks or perceptions.

II. Background and Rationale

Museums, as popular informal learning centers, strive to provide visitors with educational experiences that are as informative as they are enjoyable. While science and natural history museums aim to present the full spectrum of scientific disciplines through their exhibitions, evolution is a topic that is not often covered in great detail or in a way that places it in the context of visitor's own lives. Though sparse, there is significant research that has been done in terms of public interest and reception of exhibits on evolution. A focus group study, conducted by Minda Borun for the University of Pennsylvania Museum, found that interest in an evolution exhibit was high, and most hesitancy came from widespread unfamiliarity with what evolution is and how it works (2002). Another study conducted on the Explore Evolution exhibit at the University of Nebraska State Museum observed visitors' actions and conversations within the exhibit. They found that attending an exhibition on the topic did in fact increase visitors' knowledge and understanding of evolution and its mechanisms (Evans, et al. 2009). Evolution is also listed as an element of the Priority Areas for Research and Practice outlined at the 21st Century Learning in Natural History Settings Conference conducted by the NSF and the Smithsonian Institution (Crowley and Knutson 2014). This research and ongoing conversations in the field demonstrate that evolution is a topic of interest to both museum professionals and visitors. *Evolved* presents an opportunity to develop an informal learning experience on evolution, and to do so in the context of humans, making the process more relevant to visitor's own lives. The exhibit consists of a series of interactive and display components that provide a comprehensive look at the evolutionary history underlying the modern human body. This formative evaluation seeks to test various aspects of the exhibition, including interactives, concepts, and label text, with museum visitors. The results of this evaluation will be used to identify which aspects of the exhibition are successful at engaging visitors and delivering the exhibition's message and which are unsuccessful, as well as help to determine ways in which the unsuccessful elements can be improved. Informed by these results, changes will be made in the design of the exhibition and help to make it a more impactful, engaging learning experience.

Exhibit evaluation is a common practice in museums that has been used successfully to better understand museum visitors and develop more successful exhibitions. Several databases of similar studies exist, including those from the Institute of Museum and Library Services (https://www.imls.gov/research-evaluation) and the Center for the Advancement of Informal Science Education (http://www.informalscience.org/). Additionally, this study is being conducted under the direction of the Center for Research and Evaluation (http://lifelonglearninggroup.org/) at COSI, which has considerable experience conducting successful studies at COSI using the same recruitment, consent, and evaluation methods that will be used in this study. This collective work shows the breadth of similar studies and speaks to the importance of such studies in the field. This study is a formative evaluation, one of the major types of museum evaluation defined by evaluation expert Judy Diamond as an evaluation conducted while a project is in development in order to gather information on how it can be improved. Many previous evaluation studies, particularly other formative evaluations, use the same verbal consent procedures and gather the same types of non-sensitive demographic information that will be used and collected in this study. These studies, as in this study, are designed to fit in with potential participants museum experience, and thus are not intended to have any undue risk or burden that would compromise participant's positive experience visiting the museum. They are intended be voluntary, somewhat informal experiences that allow visitors to engage freely with the exhibit experience being evaluated, while also providing an opportunity for visitors to share their opinions and for evaluators to learn how audiences utilize and perceive the experiences they have created.

Potential pitfalls of the study are limited. Participants may be uncomfortable with the topic of the exhibition for religious reasons; however the exhibition is designed to counter such scientific skepticisms and provide a place for people to critically question and learn about evolution as a scientific principle in a comfortable and engaging environment on an elective basis. Such discomfort poses minimal risk and is, for some, part of the learning experience the exhibition seeks to provide. The nature of the experience as an exhibit also helps to minimize discomfort by making it more focused on understanding through personal interaction rather than combative discussion.

This research study has both educational benefits for society and benefits for museum professionals developing exhibits and programs. It will advance the development of an exhibition that will educate people about human evolution, increasing their scientific knowledge as well as inspiring curiosity and further exploration of evolution and biology. By putting concepts of human evolution and human biology in context, this exhibition makes people more aware of the scientific principles underlying many physical and social aspects of being human. The activities and information developed for this exhibition, as well as the evaluation process used and the knowledge gained from it, will provide examples for museum professionals developing exhibitions on similar topics or conducting similar evaluations, adding to the body of exhibition development and evaluation knowledge.

III. Procedures

A. Research Design

This is a formative evaluation designed to test components, concepts, and written text from the exhibition *Evolved*. Open-ended verbal questionnaires will be conducted to gather qualitative data on participants' perceptions of the exhibition elements and attainment of learning objectives.

B. Sample

At least 15 participants per component/concept/text tested will be needed to generate useful data. Given the number of components/concepts/texts that will be evaluated, a sample of at least 150 people is sought. Based on other evaluation work, this minimum number has been shown to be sufficient to demonstrate basic understanding of an exhibition experience. As more data will only strengthen the conclusions of the study, though, more participants will be sought. A maximum number of 700 participants will be enrolled in this study, a number that corresponds to roughly 0.1% of total COSI visitors in a year.

Participants only required characteristics are that they be COSI visitors who elect to participate in the study. By conducting evaluations within COSI, potential participants will have already been identified. Any COSI visitor is eligible to participate; therefore visitors within the COSI building will be determined to be eligible. Recruitment will take place at the Experience Testing Station setup in the COSI hallways or an exhibit space. Signage identifying it as the "Experience Testing Station" and announcing the research being done will inform visitors that an evaluation is being conducted and that participants are needed. Visitors will pass the Experience Testing Station and may either approach it voluntarily or will be asked if they are interested in helping to test new experiences as they walk by. No participants will be excluded from the opportunity to participate in the study based on age, gender, race/ethnicity, language, education, financial status, views on science, etc., as a diversity of participants is important for understanding how the exhibition is perceived and understood by a range of potential audiences. Sampling from COSI visitors does preselect for participant characteristics, however, and participants are likely to align with the demographics of COSI visitors. Participants may range in age from 5 (earliest age at which they can provide meaningful data) to 99. A relatively even distribution of participants within this age range is intended.

C. Measurement / Instrumentation

This evaluation will examine several variables of interest. Demographic information on age and gender of participants will be gathered in order to assess learning and involvement at different age levels and correct for gender bias in results. One of three participant questionnaires (component, concept, or text) will be used for each exhibit element as appropriate to assess a combination of the

following variables: what participants did and did not enjoy about elements, whether participants found elements difficult or confusing, what participants perception of the educational aim of an element was, how participants hoped to see elements improved, and/or what participants expected would expect to see in an exhibition on the element. The investigator reflection/observation questionnaire will be used for each exhibit element to assess a combination of the following variables: participant reactions to activity, participant reading of instructions and background information, participant completion of an activity, participant completion of intended steps of activity, assistance needed for participant completion of an activity, and participant discussion of an activity with non-investigators (other participants, other non-participants).

These variables will be measured using verbal questionnaires conducted after participants complete an activity and investigator observations of participants during and after the completion of an activity. The questionnaire will be addressed to the participants who completed the activity collectively, and evaluated group groups may be made up of an individual or a group of two or more people. The questionnaire is comprised of 5-6 open-ended questions. Participant's verbal responses will be recorded in a typed document.

This measurement technique will allow data to be gathered in a non-imposing, informal way that will not place an unwanted burden on participants who are first and foremost museum visitors. It will allow for the collection the data necessary for the evaluation while still making participation in the study appealing to potential participants. It is similar in structure and content to the measurement techniques used in other formative evaluations that have been proven valid and reliable.

D. Detailed Study Procedures

The evaluation will be conducted at the Experience Testing Station, and the evaluation questionnaire will be conducted at the station immediately after the completion of the activity. The Experience Testing Station is a setup used by the Center for Research and Evaluation to conduct evaluations at COSI. It consists of a large rolling whiteboard with an "Experience Testing Station" sign and a sign announcing what the research being conducted is on, as well as table or cart on which the activity will be conducted. The station will be setup in the COSI hallways or an exhibit space and operated during regular COSI hours on various days throughout the week.

Participants will be recruited from the Experience Testing Station. The investigator will remain at the station and visitors can approach the station or may be invited to participate. Upon expressing preliminary interest, the investigator will give the verbal consent statement as an introduction, to explain the research and terms of participation, and to obtain participant consent. Upon receiving consent, the investigator will begin the evaluation. Participants will commit 5-15

minutes of their time to the study from recruitment through the completion of the verbal questionnaire.

Participants will engage in an activity based on verbal or written instructions, or simply prompted to freely explore the activity. These activities will include either an interaction with an exhibit component prototype, an exercise designed to test the understanding of a concept within the exhibition, or the reading of an exhibit label text.

Throughout the evaluation, the investigator will observe participant's activity and post-activity interactions and comments. At the conclusion of the each trial they will make a typed record of their field observations based on a series of reflection questions. Upon completing the activity, participants will be given a verbal questionnaire. The questionnaire will gather demographic information including number of visitors doing the activity in a trial (the activity will likely be done by a single group of visitors who have come to the museum together, e.g. a family, a couple), the ages of the visitors in the trial group, the gender of individuals in the trial group, and the trial group's relationship to one another. Participants will be asked to voluntarily provide this information, and if they decline general observational estimates will be used instead. Participants will then be asked 5-6 open-ended questions from the questionnaire appropriate to the element being tested, a component, a concept, or text. This questionnaire is designed to gather qualitative data on the effectiveness of the particular exhibit element. Participant's verbal responses will be typed up as they are given. This data will be collected and stored on the investigator's computer to be analyzed at the completion of the evaluation.

This study does not pose greater than minimal risk. As the experience participants will have in the evaluation is similar to that which they have with the exhibits throughout COSI and would normally expect to have as visitors to the museum, it is not likely to cause greater harm or discomfort than would be ordinarily encountered by visitors during their time at COSI. The questionnaire does not contain any questions designed to provoke discomfort among participants.

The evaluation will be conducted in a public location that participants can see in advance. They will not have an expectation that their participation will be wholly private. However, the information collected is not sensitive and does not allow participants to be personally identified in any way, therefore there is little risk in participants providing it. Evaluations will be conducted one-on-one with participants so that their verbal answers to questionnaires will not be widely heard. Additionally, field observation notes and typed verbal answers to questionnaires will not be displayed to others at the museum and will be unavailable beyond the personnel conducting the study. The only exception to this is a limited number of anonymous quotes to potentially be used in written reports of the study. Verbal evaluation questionnaire answers and evaluator observations will be recorded in an electronic text document and stored on the password-

protected personal computer of the co-investigator conducting the evaluations, Abigail Sarver-Verhey. Participant confidentiality will be maintained by only collecting information that cannot be used to personally identify any participant, as well as coding the data collected. Personal information will not be collected; therefore sensitive data storage is not a concern.

E. Internal Validity

Threats to internal validity may result from the informal nature of the museum environment and exhibit experiences. Visitors in the museum setting expect to and do engage in largely free-choice exploration of exhibits and content and will carry that expectation into the evaluation. This makes the standardization of trials difficult and may result in different experiences depending on the participant. Efforts will be made to correct for such bias by conducting the activity being evaluated in a similar a manner as possible in each trial. All trails will be conducted by the same investigator, which will prevent differences of experience among trails were they to be facilitated by different individuals. Ultimately, such variability in experiences is an expected part of the final exhibition experience. Due to this fact, it can provide important data on how different visitors experience exhibit elements in different ways, bringing to light different aspects to be considered and addressed which may not have been initially. Another issue of validity pertains to participants giving positively-biased opinions on the demo if they perceive the investigator as the creator of the activity. To correct for this, the investigator will not refer to herself as the creator of the activity, but will instead describe it as though she is testing independently created content.

Threats to external validity may result from the study being conducted specifically at COSI. Participants will be restricted to actual museum visitors, excluding other demographics such as potential museum visitors and non-museum visitors who may provide very different results due to differing experience with and expectations of an exhibit. COSI's visitor demographic is also different from the visitor demographics of other museums, and thus an evaluation of *Evolved* at another museum may result in different conclusions. To correct as best as possible for this bias a broad range of participants will be recruited to understand how visitors of diverse backgrounds and museum-going experience perceive and learn from the exhibition.

F. Data Analysis

A content analysis will be used to analyze the qualitative data collected in this study. The questions asked in the questionnaire and the observation notes will be used to define categories, and participant responses and observations will be coded and analyzed for meaningful trends within and between categories. This is a standard approach to analyzing museum evaluation data. It will allow patterns to be identified within the qualitative responses and data to be compared by different variables.

IV. Bibliography

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V. Appendix: Questionnaires

Evolved: An Exhibition on Human Evolution Formative Evaluation Questionnaire: Locomotion – Childbirth Component

Participant Questionnaire

Number of participants in group: _____
Age(s): _____
Gender(s): _____
Relationship to each other: ☐family ☐friends ☐other:_____
Component evaluated: _____

1. What was your favorite thing about this activity? What was your least favorite thing?
2. Did you find this activity difficult or confusing? Why do you say that?
3. What do you think we wanted you to learn from this activity?
4. What would you expect an exhibit containing this activity to be about?
5. What could we do to make this activity better?
6. Any further comments?

Investigator Reflection/Observation Questionnaire

1. What were participant's initial reactions to the component?
2. Did participants read/listen to the instructions?
3. Did participants read/listen the background information?
4. What steps of the activity did participants do? Which did they not do? What alternative methods did they use?

Activity Step	Completed	Alternative Method
Listen to explanation of bipedalism	Y/N	
Pass head through optimal birth pelvis	Y/N	
Pass head through optimal bipedal pelvis	Y/N	
Pass head through female pelvis	Y/N	
Listen to explanation of the obstetrical dilemma	Y/N	

5. Were participants able to complete the activity? If not, why?
6. If applicable, what kind of assistance did you need to provide to participants so that they could complete the activity?
7. Did participants interact with each other?
8. Did participants discuss what they were doing/had done in the activity with one another? What did they discuss?

9. How did participants end the interaction?

Evolved: An Exhibition on Human Evolution Formative Evaluation Questionnaire: Skin Color Component

Participant Questionnaire

Number of participants in group: _____
Age(s): _____
Gender(s): _____
Relationship to each other: ☐family ☐friends ☐other:_____
Component evaluated: _____

1. **Activity Question: Based on what you've observed, why might people have different skin colors?**
2. What was your favorite thing about this activity? What was your least favorite thing?
3. Did you find this activity difficult or confusing? Why do you say that?
4. What do you think we wanted you to learn from this activity?
5. What would you expect an exhibit containing this activity to be about?
6. What could we do to make this activity better?
7. Any further comments?

Investigator Reflection/Observation Questionnaire

1. What were participant's initial reactions to the component?
2. Did participants read/listen to the instructions?
3. Did participants read/listen the background information?
4. What steps of the activity did participants do? Which did they not do? What alternative methods did they use?

Activity Step	Completed	Alternative Method
Listen to explanation of what melanin is and how it works	Y/N	
Lenses activity	Y/N	
Try to explain why people have different skin colors	Y/N	
Listen to explanation of how different levels of sunlight impact human skin color	Y/N	

5. Were participants able to complete the activity? If not, why?
6. If applicable, what kind of assistance did you need to provide to participants so that they could complete the activity?
7. Did participants interact with each other?

8. Did participants discuss what they were doing/had done in the activity with one another? What did they discuss?
9. How did participants end the interaction?

Evolved: An Exhibition on Human Evolution Formative Evaluation Questionnaire: Tool Use Component

Participant Questionnaire

Number of participants in group: _____
Age(s): _____
Gender(s): _____
Relationship to each other: ☐family ☐friends ☐other:_____
Component evaluated: _____

1. **Activity Question: What are each of these items?**
2. What was your favorite thing about this activity? What was your least favorite thing?
3. Did you find this activity difficult or confusing? Why do you say that?
4. What do you think we wanted you to learn from this activity?
5. What would you expect an exhibit containing this activity to be about?
6. What could we do to make this activity better?
7. Any further comments?

Investigator Reflection/Observation Questionnaire

1. What were participant's initial reactions to the component?
2. Did participants read/listen to the instructions?
3. Did participants read/listen the background information?
4. What steps of the activity did participants do? Which did they not do? What alternative methods did they use?

Activity Step	**Completed**	**Alternative Method**
Termite mound activity	Y/N	
Wheels activity	Y/N	
Calculator activity	Y/N	
Guess what each of the items were	Y/N	
Listen to explanation of the benefits of tools and why humans developed them	Y/N	

5. Were participants able to complete the activity? If not, why?
6. If applicable, what kind of assistance did you need to provide to participants so that they could complete the activity?
7. Did participants interact with each other?
8. Did participants discuss what they were doing/had done in the activity with one another? What did they discuss?
9. How did participants end the interaction?