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ABSTRACT

Specifically addressing and refuting common misconceptions about evolution is still a relatively new approach in education; this style of learning remains largely untested in adults outside of a classroom setting. As informal places of learning, natural history museums are the most likely environment for the general public to learn about evolutionary theory and test their misconceptions with scientific observation.

Few natural history museums have evaluated their exhibits' ability to explain evolutionary processes in a way that encourages scientific thought and addresses common misconceptions about evolutionary theory. A two-part (pre and post) survey was constructed to evaluate the educational effectiveness of the "Rattlers" and "Bringing Fossils to Life" exhibits at the Sternberg Museum of Natural History (FHSM). Both exhibits use live animals to contextualize evolutionary processes such as: (1) predator-prey relationships; (2) convergence; (3) life on land; and (4) extinction.

In future research, this survey will be utilized in the first formal evaluation of educational effectiveness in FHSM exhibits by comparing the conceptual models utilized by visitors before and after seeing the exhibits. Results will provide feedback for the museum and further evidence for the usefulness of surveys in evaluating effectiveness of museum exhibits in adult education of evolutionary theory.

OBJECTIVES

- Identify visitors' potential misconceptions about evolutionary theory.
- Develop a tool for measuring a museum exhibit's effectiveness in communicating principles of evolutionary theory.
- Prepare for the first formal evaluation of exhibits at the Sternberg Museum of Natural History (FHSM).

METHODS

The survey format is inspired by a previous study that evaluated an exhibition specifically designed to explain evolutionary concepts (Spiegel et al., 2012), but has been adapted to FHSM. A five-question survey tests visitors' conceptual models when answering questions pertaining to evolution. Two exhibits are examined: "Rattlers" and "Bringing Fossils to Life". The three schools of thought regarding evolutionary theory (Figure 1, Evans et al., 2010) include:

- Supernatural reasoning ("Things are the way there are because of the supernatural/divine.")
- Naïve Novice Naturalist reasoning ("Things change because they want to change.")
- Informed Scientific Naturalist reasoning ("Evolution happens through random mutation and non-random selection of these mutations.")

This survey is given to guests twice: once as a pre-survey to test their pre-existing conceptual models and then as a post-survey to determine if a mental shift occurred after visiting the exhibits. Study participants will be provided partial compensation via a fast food coupon. Questions will be assigned a random order in the post-survey. Both parts of the survey are given out in a typed format and will be answered in open-ended writing.

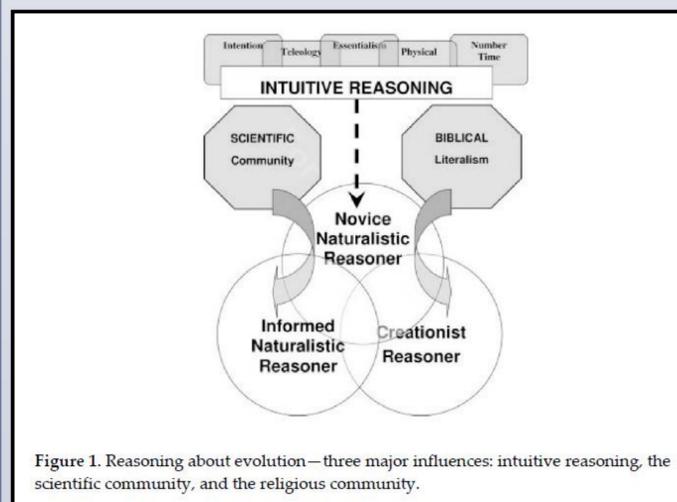


Figure 1. Reasoning about evolution—three major influences: intuitive reasoning, the scientific community, and the religious community.

Figure 1 from Evans et al., 2010

METHODOLOGY

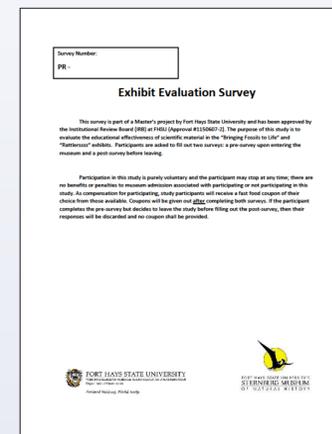
Questions for the survey were developed by examining key concepts of evolutionary theory presented within the exhibits and finding misconceptions that could be applied to these concepts. Possible misconceptions could include (but are not limited to): (1) soft inheritance of venom resistance; (2) dismissal of species-specific banding patterns as random 'mutation'; (3) mistaking mudskippers for amphibians instead of fish (essentialism); (4) claiming that the same animals have always existed; and (5) listing predation as the only factor of extinction in large animals (Gregory, 2009).

Survey questions were left open-ended so that the visitor may answer using any combination of the three conceptual models. Specific words, such as 'evolution' and 'God', were deliberately left out of the questions to prevent priming visitors to answer in a particular way. Answers will be analyzed not for exact content, but instead for which conceptual models they represent.

SURVEY QUESTIONS

- Why do the different species of rattlesnake on display have different colors and striping patterns?
- For what reasons might fish like mudskippers go onto land, despite having gills that breathe underwater? What changes would be necessary for them to move further inland or stay out of water longer?
- Scientists have found the remains of large turtles, sometimes over 11 feet long. Why might we not see turtles of this size around today?
- Why might squirrels and mice have a higher resistance to rattlesnake venom than other animals?
- Fossil animals and plants can look very similar to those living today. Why might that be the case?

In addition to the answers to these questions, data collected includes the visitor's ethnicity, race, age, gender, and educational background. Visitors will also answer if this is their first visit to the museum or a repeat visit, as well as whether they are a Hays area resident or not. Results will be scored based on the presence or absence of the three conceptual models and their usage percentages.



FUTURE RESEARCH

Survey data collected at the museum will be qualitatively analyzed to test if "Rattlers" and "Bringing Fossils to Life" have any statistically significant effect on utilization of scientific concepts within adult museum visitors. These findings will be used by FHSM staff to perform self-evaluation as well as to further develop evaluation methods for natural history museum exhibits in the field of evolution education.

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