



A Conceptual Guide to Museum Visitors' Understanding of Evolution

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Abstract

Purpose: The purpose of this study was to profile natural history museum visitors' reasoning about the evolution of seven organisms featured in *Explore Evolution*, an NSF funded exhibition. Seven current research studies on evolution were exhibited; each targeted different organisms: HIV, diatoms, ant/fungus, Hawaiian flies, Galapagos finches, humans/chimps, and fossilized whales. The exhibits illustrated a common set of evolutionary principles, variation, inheritance, selection, time, and adaptation, in diverse organisms.

Method: As part of the front-end evaluation, 32 museum visitors were interviewed and asked to explain evolutionary change in the seven organisms, though the term evolution was not mentioned. Based on a novel conceptual framework, responses were coded into three reasoning patterns: *Informed naturalistic reasoning* - one or more core evolutionary concepts; *Novice naturalistic reasoning* - intuitive modes of reasoning; and *Creationist reasoning* - supernatural explanations.

Findings: In contrast with the general public, which is 45% creationist (Gallup, 2004), only 28% of the sample exhibited creationist beliefs. None of the visitors, though, were exclusively evolutionist. Instead, visitors were *mixed reasoners* using more than one of these reasoning patterns in different permutations across the seven organisms. Even so, most visitors did exhibit a dominant reasoning mode: 34%, informed naturalistic reasoners, 53%, novice naturalistic reasoners, 6%, creationist reasoners. The human/chimp problem elicited the most creationist reasoning, the HIV, diatom, fly and ant problems, the most novice naturalistic reasoning, and the finch, whale, and human/chimp problems the most informed naturalistic reasoning.

Research Questions

1. How do natural history museum visitors reason about evolution?
2. Does a novel conceptual framework, which is based on earlier research on the emergence of evolutionary ideas, successfully profile museum visitors' reasoning patterns across diverse organisms?
3. Do different organisms elicit characteristic reasoning patterns?

Participants and Procedure

Participants

- 32 museum visitors (18-65 yrs) from three Midwest natural history museums (38% male; 97% non-Hispanic white; 3% multiracial)
- Education Levels: 19% High School; 22% 2-year college; 60% 4-yr college+ (typical of science/natural history museums, Korn, 1995)

Procedure

- Randomly selected visitors were asked to take part in an audio-taped interview in which they explained 7 evolutionary problems, each focused on a different organism. The term evolution was not mentioned.
- Fixed presentation order: Fly, finch, HIV, diatom, ant, whale, human

Conceptual Framework

Reasoning Patterns:

- **Informed Naturalistic Reasoning:** Use of an evolutionary term or concept (e.g., variation, inheritance, selection).
- **Novice Naturalistic Reasoning:** Proposes a natural explanation, but relies on intuitive modes of reasoning
- **Creationist Reasoning:** Proposes supernatural rather than natural explanations; particularly God's direct role

Coding:

- Each *reasoning pattern* was made up of 8-10 distinct themes
- The *themes* were based on research on the emergence of evolutionary concepts (e.g., Evans, 2001) and the content analysis.
- A *content analysis* of the 32 transcribed interviews identified 601 distinct conceptual units that mapped on to the above themes.
- For each participant's response to each organism, each theme was recorded as present (1) or absent (0), even if the theme was repeated.
- Initial reliability 86-100%; All responses coded to 100% reliability

Results: Reasoning Patterns

Overall: Across Organisms. (Mixed reasoning profiles)

- 72% informed naturalistic & novice naturalist reasoning
 - 28% informed & novice naturalistic & creationist reasoning
- ### Dominant Reasoning Patterns. (Most consistent responses)
- 34% informed naturalistic reasoning
 - 54% novice naturalist reasoning
 - 6% creationist reasoning
 - 6% no dominant pattern

Informed Naturalistic, Novice Naturalistic, Creationist Reasoning Patterns

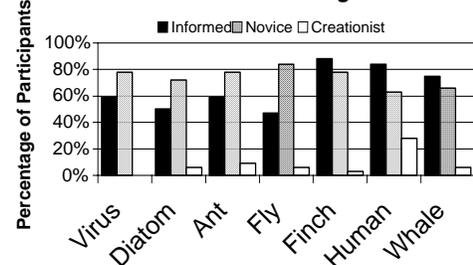


Figure 1: Reasoning Patterns By Organism. The percentage of participants endorsing at least one theme from each of the patterns.

- The *finch, human/chimp, and whale* problems elicited the most informed naturalistic reasoning
- The *fly, ant, diatom, and virus* elicited the most novice reasoning
- The *human/chimp* elicited the most creationist reasoning

Examples of Visitors' Responses

Finch: This question addressed the relative change in the size of the beaks of the Galapagos finch population from one year to the next.

▪ **Informed Naturalistic Reasoning:** "Well, in that case I would assume that the birds evolved - well, the birds with the larger beaks were the ones better able to survive, since the larger beaks were more useful in getting the seeds. So that trait is the one that was selected for, and the birds that had the smaller beaks died out, I would assume. They didn't produce as many offspring."

▪ **Novice Naturalistic Reasoning:** "...Well, in order to survive, their body parts had to adjust to certain things, similar to the way giraffes' necks probably grew long as they reached for the plants at the top of the trees, so the beak grew longer in order to deal with the tougher seeds."

▪ **Mixed Creationist/Informed Naturalistic Reasoning:** "That's a good question. I probably can't explain that. But like I said, because of my biblical world view, I don't believe in evolution. So I don't believe that they evolved because it takes too long..., so I just reject that view. *Um, my guess would be that there probably were larger beaked finches but there weren't as many of them and the small beaked ones would have died out because they couldn't get the food. But I don't think that it went the other way-that there were no large beaks and so they grew into large beaks.* So is that clear enough?" [**Informed naturalistic reasoning in italics**]

Summary and Conclusions

▪ In contrast with the general public (45% creationist), only 28% of these natural history museum visitors exhibited creationist beliefs. All visitors, however, were mixed reasoners using two or more of the three reasoning patterns in different combinations across the 7 organisms

▪ Even so, most visitors did exhibit a dominant reasoning mode: 34%, informed naturalistic reasoners, 53%, novice naturalistic reasoners, 6%, creationist reasoners (6% did not have a dominant pattern).

▪ The human/chimp problem elicited the most creationist reasoning. The HIV, diatom, fly and ant problems, the most novice reasoning, and the finch, whale, and human the most informed naturalistic reasoning.

▪ Although, natural history museum visitors exhibited less creationist reasoning than the general public, only one third were well-informed about evolutionary processes. Even more surprising, they did not spontaneously apply evolutionary explanations to all living things. Different organisms elicited characteristic reasoning patterns.

▪ This study confirms the utility of a novel conceptual model to profile the reasoning patterns of museum visitors. This could help museums as they determine how best to present evolutionary ideas to the public.

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