

# Identifying Misconceptions about Natural Selection with Minute Papers, Brainstorming, and Peer Teaching

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## Introduction

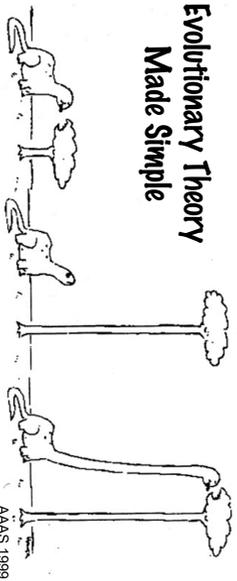
Students harbor persistent misconceptions about evolution. Although required to compare and contrast Lamarck's theory of evolution with natural selection in my Historical Geology (Geos 112) class, geology and biology majors in my upper-division Paleobiology (Geos 315) course continue to describe evolution in surprisingly Lamarckian terms. I use the two-part exercise below as a review of what students know (or think they know) about natural selection. The primary objective is:

- ➔ To increase understanding of natural selection by exposing misconceptions

## Part I: Minute Paper

Near the end of a class session, students are shown a cartoon (below). Each student is given a note card and asked to explain what is going on in the cartoon in terms of natural selection. When they are finished, they put their names on the cards and hand them in. Typically these "minute papers" take about 5 minutes. After class, I read the note cards to assess the students' understanding and identify the most prevalent misconceptions. If confusion is widespread, I open the next class with a discussion of several representative (and anonymous) submissions. If 50% or more of the students demonstrate a basic grasp of natural selection, I proceed directly to the second part of the exercise.

### Evolutionary Theory Made Simple



AAAS 1999

- #### Minute Paper
1. Examine the cartoon.
  2. Explain the changes occurring in the tree AND the animal using your current understanding of natural selection.
  3. Working individually, write your answer on a card and hand it in.

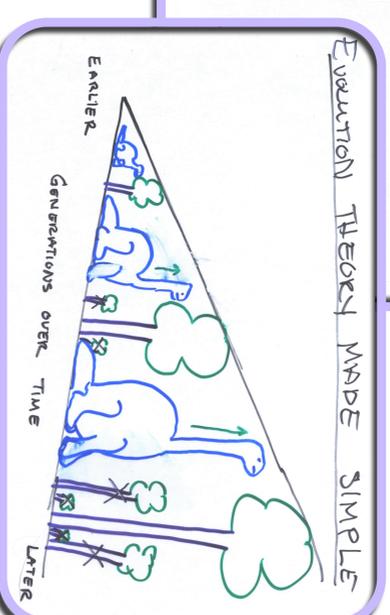
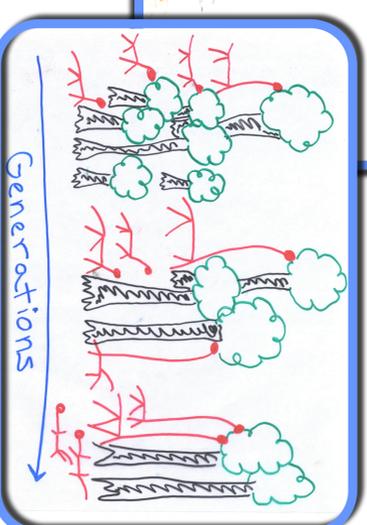
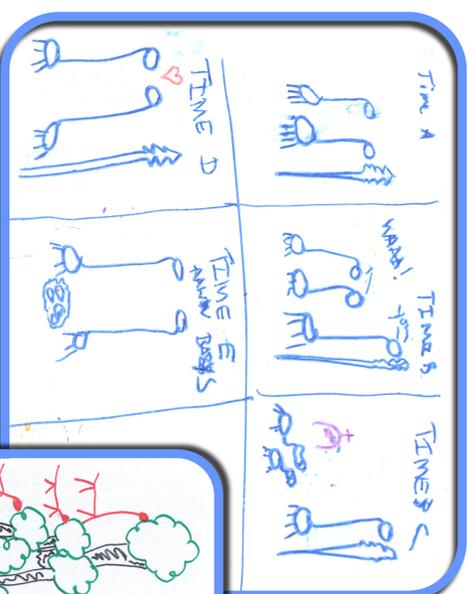
## Part II: Brainstorming

Working in groups of 3 or 4, students are asked to design an improved version of the cartoon that eliminates some of the potential misconceptions (below). Each group is given a transparency and several overhead markers on which to draft their cartoon. After ~15 minutes, I collect the transparencies and show them to the class as the basis for discussion. Group members are invited to explain which misconceptions they have targeted with their modified version of the cartoon. Examples of student work from 2007 and 2008 are shown at right.

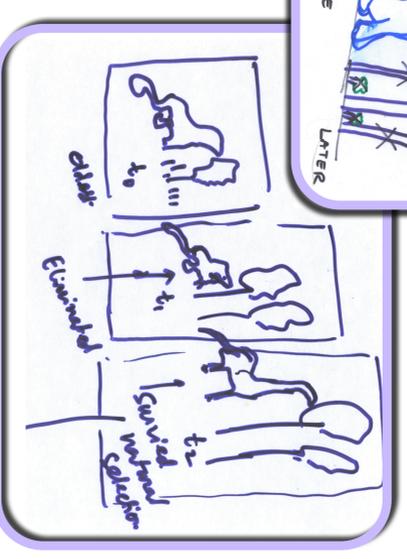
### Brainstorming

1. Working in groups, design a modified version of the cartoon that eliminates some of the potential for misconceptions.
2. Draw your cartoon on a transparency sheet and hand it in.

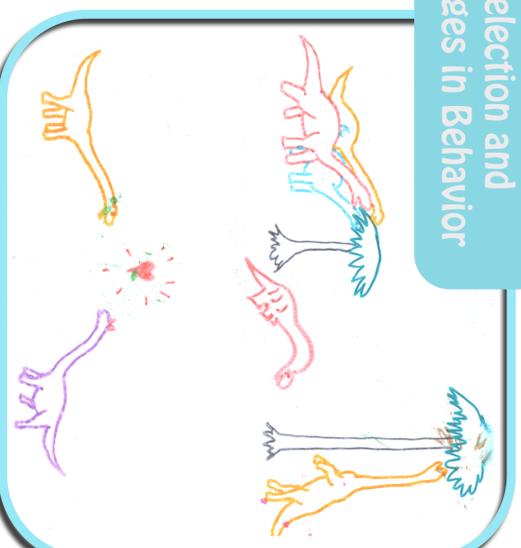
## Student Work Recognizing the Importance of Population Variation



## Examples of Student Work Recognizing the Importance of Geologic Time



## Student Work Highlighting Sexual Selection and Changes in Behavior



## Learning Outcomes

Students enjoy the exercise, promoting retention. Through completion of the minute paper followed by a small group exercise and large group discussion, students demonstrate or acquire the ability to:

- ➔ Recognize common misconceptions about evolution (their own and others')
- ➔ Identify factors important to natural selection
- ➔ Discriminate between natural selection and inheritance of acquired characters and articulate the differences to peers and instructors

## Acknowledgements

The overheads presented above were drafted by my students, but the exercise itself has been extracted from a *teachable unit* presented at the 2007 National Academies Summer Institute on Undergraduate Education in Biology.

I wish to acknowledge the members of the Evolution Working Group who designed this exercise and made it available to others:

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