The Great Clade Race – Zombie Island Edition

Overview: This activity (a modification of the "Great Clade Race" by Goldsmith, 2003). is great for helping students understand cladograms/phylogenies, but the original reinforces some problematic misconceptions (like "evolution is directed" or "characters are predetermined"). The Zombie Island version works to avoid these misconceptions while leveraging the positive aspects of the "Great Clade Race". The activity can be done as an active learning activity in a class or during lab and usually only takes ~15-25 minutes.

Class Level: This activity can be used in an introductory "Life Through Time" course (i.e., a freshman history of life class in Geology/Geoscience/Biology). That said, it would work in a high school Biology class or any undergraduate Paleontology/Evolutionary biology class.

Scaffolding: This is a pretty good entry-level activity, but a short lecture about cladistics is a good way to lead into it (or summarize the activity). You could also have students lump the cards into groups before running the activity based on characteristics of their choosing (number of colors, number of symbols, etc.), in order to set up a discussion of cladistic versus non-cladistic classification schemes.

Goals: From Goldsmith (2003): "For many students, an introductory lecture on cladistics comes across as an onslaught of strange new terms and opaque jargon. By the time they have even begun to learn the meaning of words like "synapomorphy," "homologous," and "parsimony," many of them have already reached the conclusion that cladistics is something so complex that they simply cannot understand it. Once a student arrives at this conclusion, it is particularly difficult to lead him or her past it. I have developed a simple puzzle to begin my introductory cladistics lessons that allows students to use cladistic thinking without first bogging them down with terminology. In classes where I have used this exercise, which I call the Great Clade Race, students not only begin their approach to cladistics with a more positive attitude, they also seem to have a better comprehension of what cladistics does and why cladistics is used."

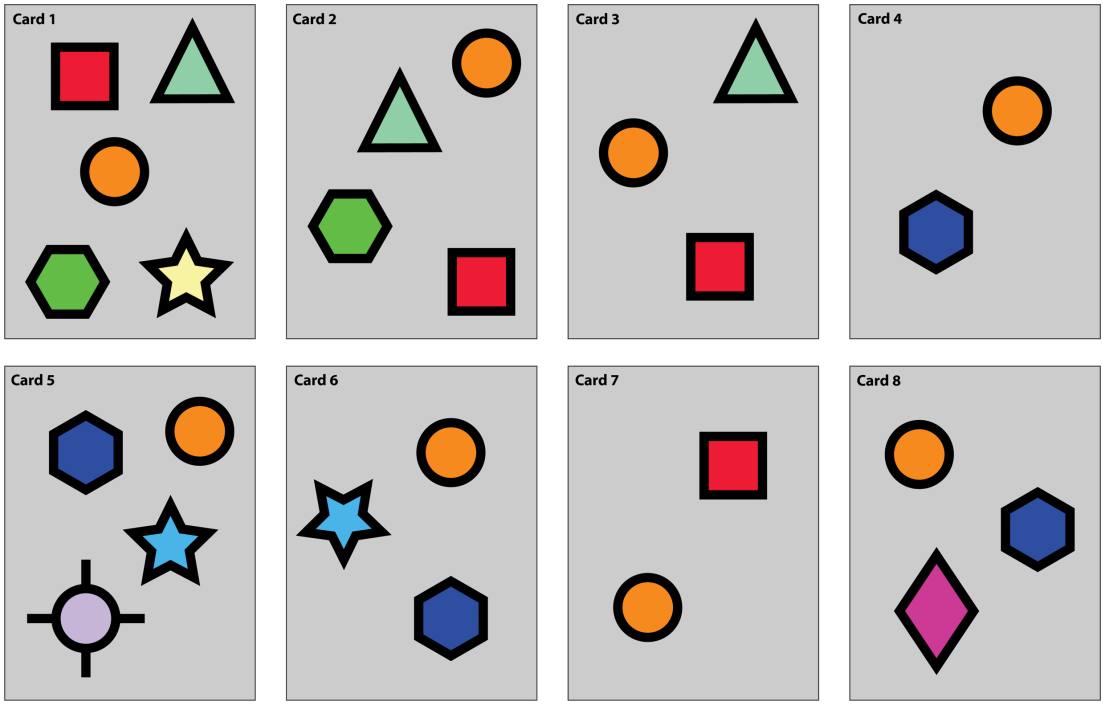
Activity: Divide the class into groups of 3 to 4 students (one submission per group). These collaborative teams act like forensic scientists (like CSI) and have a goal of reconstructing the events on Zombie Island based on clues from the cards the survivors carry. Teams get a set of 8 cards with symbols (shown on the next page); students use logic to reconstruct everyone's escape route based on the clues found on their cards!

Have students trace a path (or phylogeny) based on the following rules:

1. Zombies infested this island (see map on page 3), the island people had to get away, so they ran to the beach to swim to safety!
2. They left the stronghold by a single exit.
3. The only safe way off the island was the northern beach
4. They escaped from anywhere on the northern side of the island
5. They could not retrace their path or go back (zombies!!!)

6. People ran through the woods in groups or split up
    - People either stayed with their group or split in two
    - People never (re)joined a group (they might be zombies!)
7. Each person has a card that captured pollen from plants
8. As they ran, each person passed vegetation with unique pollen that got stuck to their card.
9. Everyone made it to the beach!

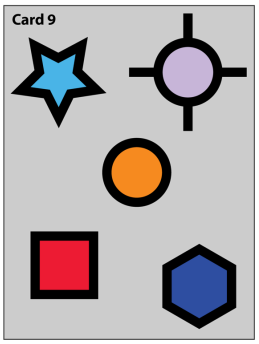
Cards with symbols depicting pollen (modified from Goldsmith, 2003)



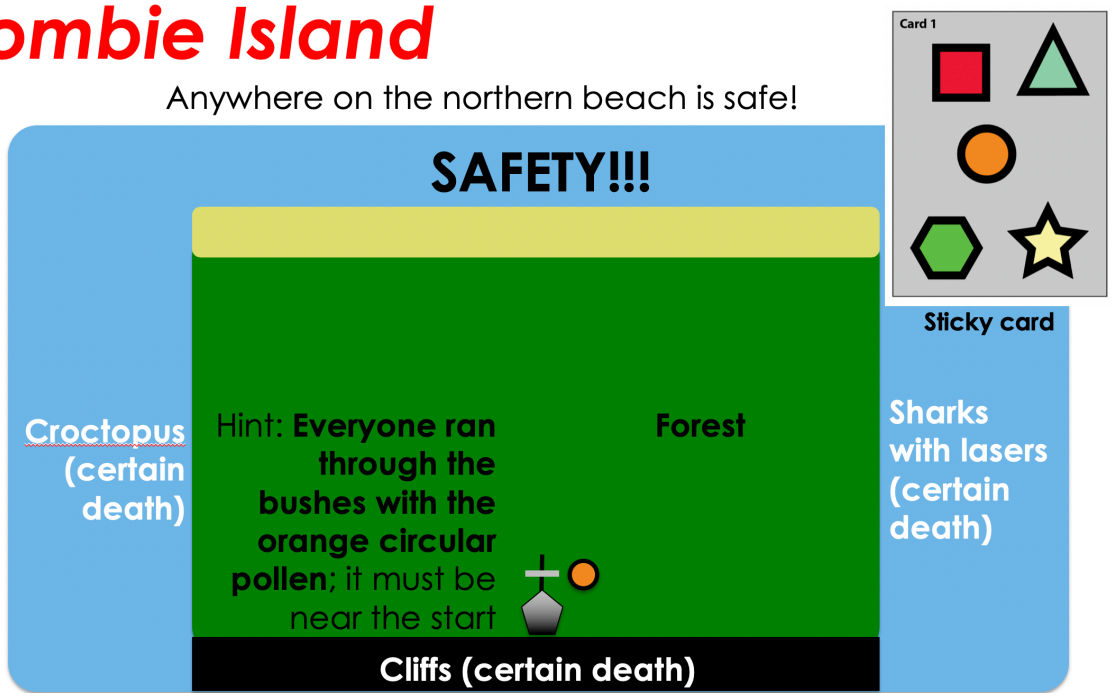
Deliverable #1: Using the sticky cards collected from the survivors in the water, reconstruct.
- Sketch the paths of escape from Zombie island
- Show all patches of vegetation people passed through (on the straightaways)
- Mark the beach exit used by each person

Deliverable #2: Compare your map with another group's map; do they look identical? If not, does their map still work (i.e., can maps that look different represent the same data)?

If your teams finish early, give them a ninth card.
Deliverable #3: Add this ninth survivor to your map. Do you encounter any problems? What might these issues tell you?



Zombie Island



Notes

- As the students complete this task the TAs and Professor walk around the class to help.
- Students may initially doubt that they have enough information to complete the assigned task. The hint in slide #13-14 of the attached PowerPoint is very helpful in helping them see what they need to do.
- ***This restructuring of the "Great Clade Race" still helps them learn about using characters to draw relationships (i.e. tracing which groups split and which stayed together) but it avoids several problematic aspects of the Great Clade Race (e.g., predetermined paths of the runners).***

Assessments: Discuss cladistics terminology with the students and ask them to identify what parts of the activity represent synapomorphies, (sym)plesiomorphies, and autapomorphies (see hint on slide 19 of the attached PowerPoint). Ask students to identify the assumptions that went into their model. What new assumptions did they realize they had made after working with the ninth card (see hint on slides 21-25 of the attached PowerPoint)?