Professional Development to Improve Spatial Thinking of Earth Science Teachers & Students (Session 5)

Perspective Taking

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Last Month: Multiple Representations

• Challenge #1: Distinguish commonalities and differences among similar representations (same content, same vantage point)

• Challenge #2: Combine information from two spatial representations, when both are from the same perspective

• Challenge #3: Combine information from two spatial representations which are from different perspectives
View from above: Map view

View from the side: Profile view

Perspective Taking!
Perspective Taking:
Envisioning what an object or system would look like from different vantage points

A  "Here is a view of a landscape."

B  "Here is a map of the same landscape seen from above. Would you see the view above if you were standing at position A, B, C, or D on the map?"
Why is perspective taking necessary or useful?

• Our eyes can only see a 3-D object or system from one perspective at a time, projected onto a 2-D surface, the retina.

• Our mind combines information from multiple perspectives to build up a 3-D understanding of the shape of an object or the motion of the system.

• Earth Scientists use 2-D representations to communicate about Earth structures and systems, and rely on the viewer to be able to use perspective-taking to fill out the three dimensionality of the structure or system.
Spatial Thinking in the New York State High School Earth Science Exam

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Frequency of Spatial Skills subcodes:

- Mental Animation: 15%
- Represent. Correspond.: 10%
- Perspective Taking: 7%
- Describe: 6%
- Sequence: 4%
- Visual Penetrat. Abil.: 1%
**Difficulty of spatial versus non-spatial categories**

- **Hardest Spatial Concepts**
  - Trajectory (14 percentage points worse than average spatial item)
  - Gradient (5 points worse)

- **Hardest Spatial Representation**
  - Solar System (9 points worse)

- **Hardest Spatial Skills**
  - Describe spatial phenomena (5 points worse)
  - Perspective taking (4 points worse)
The diagram below shows the Moon at four positions in its orbit around Earth as viewed from above the North Pole. The date of one of the four positions has been labeled.

Which photograph shows the appearance of the Moon as viewed by an observer in New York State on May 17, 2000?
Another Regents question requiring perspective taking

Base your answers to questions 47 through 50 on the diagram below, which represents the Sun’s apparent paths and the solar noon positions for an observer at 42° N latitude on December 21, September 23, and June 21.

47 In which direction will sunrise occur on June 21?
   (1) north of due west
   (2) north of due east
   (3) south of due west
   (4) south of due east
Imagine you are standing at the **flower** and facing the **tree**.

Point to the **cat**.

In the circle is an arrow showing the direction you imagine you are looking.

Draw another arrow to show the direction you imagine pointing.

A glimpse of how cognitive scientists study perspective taking.
Imagine you are standing at the flower and facing the tree.

Point to the cat.

In the circle is an arrow showing the direction you imagine you are looking.

Draw another arrow to show the direction you imagine pointing.
Participants are 164 Regents Earth Science Students

Scores Within 15°

If you score much better than Regents ES students, beware!
Big problem at the college level: Many Geo instructors are much better at spatial visualization than their students.

Do spatially strong individuals self-select into Geosciences? Or did they get spatially strong through the practice of Geosciences? Or both?