What do Geoscience Novices Look at and What do They See when Viewing and Interpreting Data Visualizations?

Kim A. Kastens (EDC Learning & Teaching Division, kkastens@edc.org)
Thomas F. Shipley and Alexander Boone (Temple University, Department of Psychology)

What we know:
• Interpreting data visualizations is central to the professional practice of most kinds of geoscientists.
  - Geoscientists can make inferences about structures, processes and history from data representations—even when they didn’t see the causal event, and even when they have not personally experienced the place depicted.
  - Many students cannot do this—even when the data visualization is highly iconic, resembling the referent they have not personally experienced the place depicted.

What we wish to find out:
• How do experts do this?
• How can we help students move towards this ability?

Methods:
Experimental task: provide answers to follow-up questions about what participants see and how they interpret what they see.

Protocol:
Participant views specific areas of the image.

Findings:

Familiar versus unfamiliar landscape

1. What do you think this image is showing? [follow-up questions]
2. What processes do you think might have shaped this part of the Earth’s surface? [follow-up questions]
3. Can you give me any more detail about what you think is going on in this image?
4. What do you think you would see if you could see a larger area of the Earth than what we are seeing here? If you could see outside the frame of this image? [follow-up question]

On each hi-res image, specific areas were highlighted for further questioning:

(1.5) What do you think this image is showing? [follow-up questions]
(1.4) What processes do you think might have shaped this part of the Earth’s surface? [follow-up questions]
(1.3) Can you give me any more detail about what you think is going on in this image?
(1.2) What do you think you would see if you could see a larger area of the Earth than what we are seeing here? If you could see outside the frame of this image? [follow-up question]

Then they saw four high resolution images, in random order:

(2.1) What do you think this is?
(2.2) OK, good, so you have told me that you think this is a [map/picture/thing] and [map/picture/thing]
(2.3) Was there anything in the image that led you to that interpretation?
(2.4) Could you please point to an example of where you think the image is showing [map/picture/thing]?

Wrap up Questions:
(4.1) How do you think these images that we’ve been looking at were made?
(4.2) What do you think these images are useful for?
(4.3) Think back over all the images. As you were trying to come up with the answers to my questions, what sources of knowledge did you draw on?
(4.4) Think back over all the images. As you were trying to come up with the answers to my questions, what sources of knowledge did you draw on?
(4.5) What do you think these images are useful for?
(4.6) What do you think these images are useful for?
(4.7) What do you think these images are useful for?

Spatial Abilities Assessment:

- Test your ability to visualize and interpret a 3-D data volume, and if so, how?
- How do students approach the task of interpreting a data visualization?
- How experts do this?
- How do students approach the task of interpreting a data visualization?

Familiar versus unfamiliar landscape

Prior study of Earth Science

Eye-tracking data: "Areas of Interest"

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