Better Graphics

For knowledge transfer
... building relationships and partnerships can help make scientific research not only decision-relevant, but also understandable to key stakeholders - success in itself.

ENQUIST et al., 2017:545
You must unlearn what you have learned.
—Yoda
SIMPPLICITY
SIMPLY PRESENTING

by kiyomi morino
“Do only what is necessary to convey what is essential...”

- Richard Powell, Author of *Wabi Sabi Simple*
Visual Salience in Climate Change Imagery is in the Eye of the Beholder

Julie C. Libarkin

Geocognition Research Lab, Department of Geological Sciences and Center for Integrative Studies in General Science, Michigan State University, East Lansing MI, USA

Stephen R. Thomas

Department of Zoology and Center for Integrative Studies in General Science, Michigan State University, East Lansing MI, USA

Gregory Ruetenik

Geocognition Research Lab, Department of Geological Sciences, Michigan State University, East Lansing MI, USA
3

Foundational Concepts
Conclusions
Recommendations
1. Visuals play a significant role in transferring knowledge.
“...the more visual the input becomes, the more likely it is to be *recognized* -- and *recalled*.
1. Visuals play a significant role in transferring knowledge.

2. The communication value of these visuals is highly dependent on their design.
1. Visuals play a significant role in transferring knowledge.

2. The communication value of these visuals is highly dependent on their design.

3. Accurate transfer of information is an essential first step to environmental behavior \[for us: co-producing usable science\].
Seeing ≠ Understanding
Viewers cannot learn from an image when they do not focus on the appropriate aspects of an image that are required to convey a scientific meaning.
How?
1. Select participants

12 participants:
• Novice: 9 undergraduates, non-science majors
• Expert: 1 undergraduate science major, 1 graduate student, 1 science professor

2. Collect data
Participants were asked to evaluate 4 common IPCC images: “What was the main message of the image you viewed?”

Eye movement as they studied the image was tracked and recorded.

3. Analyze data

4. Revise images and repeat Steps 2 & 3
Methods: Data Analysis

GAZE PLOTS

Diagram:

1. Node 1
2. Node 2
3. Node 3
4. Node 4

Connections:
1. Node 1 to Node 2
2. Node 2 to Node 3
3. Node 3 to Node 4
Methods: Data Analysis  HEAT MAPS
Figure 2. The present carbon cycle

Volumes and exchanges in billions of tonnes of carbon

Sources: Center for climatic research, Institute for environmental studies, university of Wisconsin at Madison; Okanagan university college in Canada, Department of geography; World Watch, November-December 1996. Climate change 1995. The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university. 1996.

Courtesy of UNEP/GRID-Arendal (http://maps.grida.no/go/graphic/the-carbon-cycle)
Variations of the Earth's surface temperature: year 1000 to year 2100
Results: Image 1 - GAZE MAP “What was the main message of the image you viewed?”

- Both Novice and Experts viewed in a disjointed manner
- Both Novice and Experts in a cyclic, organized manner
Gaze Map for 4 Novice participants

ORIGINAL IMAGE

• **Text elements** attract gaze and fixation
• **Artistic elements** attract gaze and fixation
Results: Image 1 - HEAT MAP

Gaze Map for 4 Novice participants

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Gaze Map for 4 Novice participants

ORIGINAL IMAGE

• **Text elements** attract gaze and fixation
• **Artistic elements** attract gaze and fixation

REVISED IMAGE

• **Text elements** attract gaze and fixation
• **BUT...**
Results: Image 1 - HEAT MAP

Gaze Map for 4 Novice participants

ORIGINAL IMAGE

• **Text elements** attract gaze and fixation
• **Artistic elements** attract gaze and fixation

REVISED IMAGE

• **Text elements** attract gaze and fixation
• BUT... more uniform viewing among participants
Variations of the Earth’s surface temperature: year 1000 to year 2100
Results: Image 2 - HEAT MAP

Gaze Map for 4 Novice participants
ORIGINAL IMAGE

- *Text elements* attract gaze and fixation
- *Increase and projection* attract gaze and fixation
Results: Image 2 - HEAT MAP

Gaze Map for 4 Novice participants

- **Text elements** attract gaze and fixation
- **Increase and projection** attract gaze and fixation
Results: Image 2 - HEAT MAP

Gaze Map for 4 Novice participants

ORIGINAL IMAGE

REVISED IMAGE

• **Text elements** attract gaze and fixation
• **Increase and projection** attract gaze and fixation

Temperature increases in modern times.
Gaze Map for 4 Novice participants

**ORIGINAL IMAGE**

- **Text elements** attract gaze and fixation
- **Increase and projection** attract gaze and fixation

**REVISED IMAGE**

- **Text elements** attract gaze and fixation
- **Increase and projection** attract gaze and fixation
- BUT... more focused viewing of axes

**Temperature increases in modern times.**
3 Conclusions
• Experts had a more purposeful* gaze
• Expert-like gaze could be induced in Novices by revising the image

*Note: The term “purposeful” is used with an asterisk to indicate that it may be a non-standard or informal usage in the context.
Conclusion #2

- Text attracts the eye
- Visuals should reinforce text and vice versa

- **Text elements** attract gaze and fixation
Conclusion #3

• Pictorial elements attract the eye

• In describing the carbon cycle, more emphasis was placed on sources/sinks vs processes

• In describing the carbon cycle, more balanced recognition of sources/sinks AND processes
3

Recommendations
Establish the objectives behind creating a visual

Communicators must identify the VALUE of the information:

For the image presented, what information is necessary for novice understanding of the phenomenon/process?
Establish the objectives behind creating a visual

Communicators must identify the VALUE of the information:

For the image presented, what information is necessary for novice understanding of the phenomenon/process?

Which phenomena and processes are necessary for transferring usable knowledge?
Recommendation #2

Create purposeful images by considering design elements

What level of abstraction is optimal?
Recommendation #2

Create purposeful images by considering design elements

What level of abstraction is optimal?

What is the required background knowledge needed to correctly interpret image?
Recommendation #2

Create purposeful images by considering design elements

What level of abstraction is optimal?

What is the required background knowledge needed to correctly interpret image?

Which graphic elements should be included?
Recommendation #3

Is the information correctly getting through?

- Think-aloud discussion
- Eye tracking
- Focus groups
Thank-you!