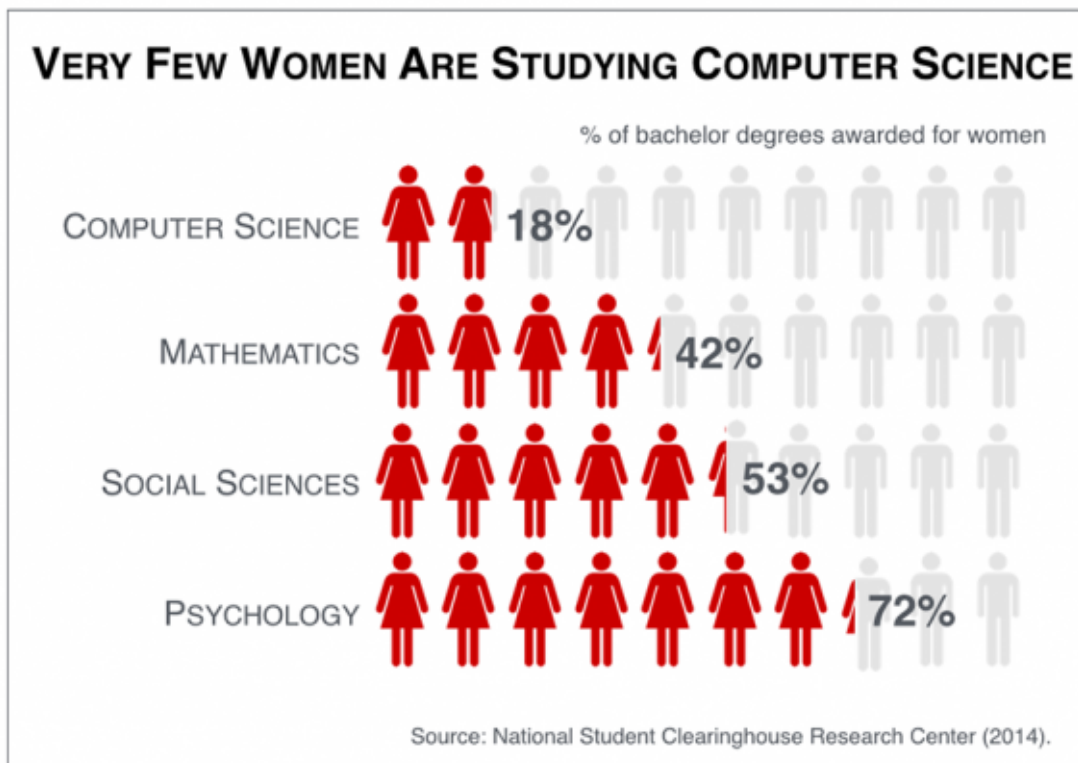


Eye-tracking research reveals which types of visuals actually get the message across

November 6 2015, by Adam Conner-Simons



CSAIL researchers found that pictograms, often ridiculed for “dumbing down” complex topics, do not negatively affect memorability and, when employed appropriately, can dramatically improve information recall. Credit: Nam Wook Kim

Spend 10 minutes on social media, and you'll learn that people love

infographics. But why, exactly, do we gravitate towards articles with titles like "24 Diagrams to Help You Eat Healthier" and "All You Need To Know About Beer In One Chart"? Do they actually serve their purpose of not only being memorable, but actually helping us comprehend and retain information?

Researchers from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) and Harvard University are on the case.

In a new study that analyzes people's eye-movements and text responses as they look at charts, graphs, and infographics, researchers have been able to determine which aspects of [visualizations](#) make them memorable, understandable, and informative—and reveal how to make sure your own graphics really pop.

Presenting a paper last week at the proceedings for the IEEE Information Visualization Conference (InfoViz) in Chicago, the team members say that their findings can provide better design principles for communications in industries such as marketing, business, and education, as well as teach us more about how human memory, attention, and comprehension work.

"By integrating multiple methods, including eye-tracking, text recall, and memory tests, we were able to develop what is, to our knowledge, the largest and most comprehensive user study to date on visualizations," says CSAIL PhD student Zoya Bylinskii, first-author on the paper alongside Michelle Borkin, a former doctoral student at Harvard's John A. Paulson School of Engineering and Applied Sciences (SEAS) who is now an assistant professor at Northeastern University.

The paper's other co-authors include Bylinskii's advisor, MIT principal research scientist Aude Oliva; CSAIL research assistant Constance May Bainbridge; Harvard graduate student Nam Wook Kim, former Harvard

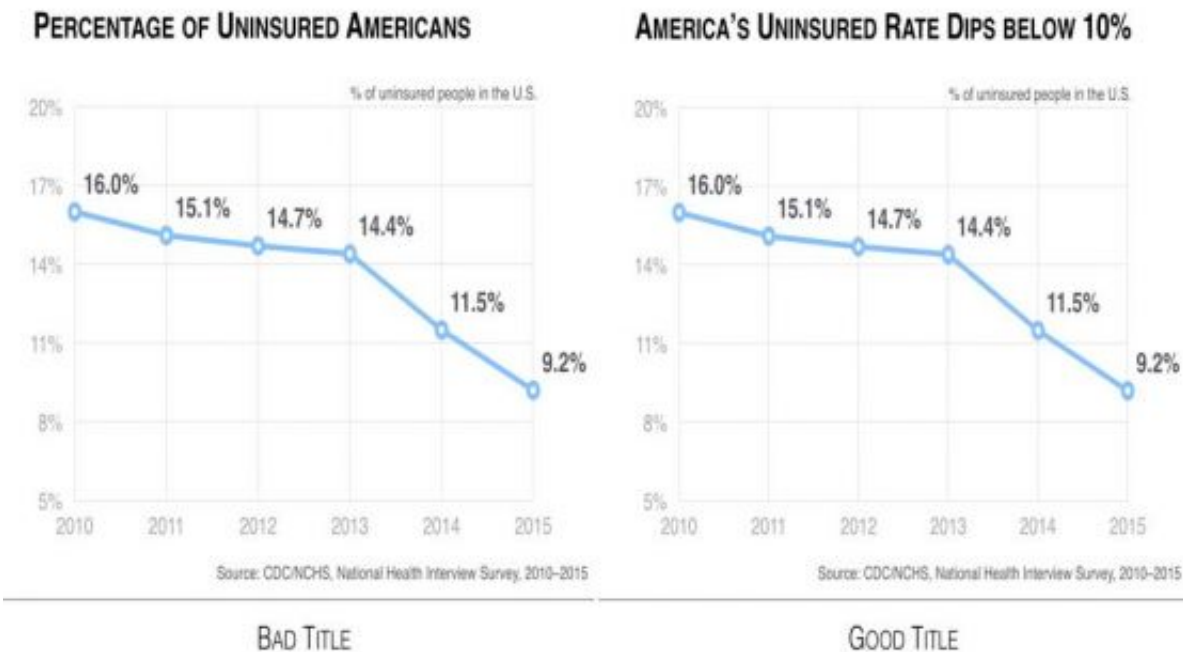
undergraduate Chelsea S. Yeh and research intern Daniel Borkin; and Harvard professor Hanspeter Pfister.

Among the top tips for aspiring data-viz designers:

Make your title count

While the "visuals" in your visualization are important, people actually spend the most time on the text—and, above all, your title.

The study found that the strongest visualizations have titles that use concise, descriptive language to sum up the take-away message.



An MIT-Harvard University study found that the strongest visualizations have titles that use concise, descriptive language to sum up the take-away message. Credit: Nam Wook Kim

"People often include titles that don't add anything to what is already shown," says Jean-Luc Doumont, author of the seminal science communications book "Trees, Maps, and Theorems." "If a chart's axes are labeled 'temperature' and 'time,' then 'the evolution of temperature over time' is much less meaningful than, for example, 'temperature increased much faster than anticipated.'"

Pictures are worth more than a few words

Of course, being too text-heavy would defeat the entire purpose of the medium. Pictures and graphics give readers additional associations that help them retain and recall the content.

Specifically, the study's results suggest that pictograms, often ridiculed for "dumbing down" complex topics, do not negatively affect memorability and, when employed appropriately, can dramatically improve information recall.

Repeat, repeat, repeat

As any marketing expert can tell you, repetition is crucial to getting your message across. Strong visualizations provide multiple ways of conveying and labeling information.

For example, if you want to emphasize differences between a series of numbers, it may be helpful to actually spell out the exact number, or add proportionally-sized bubbles that give the viewer a sense of scale.

All of these strategies increase your content's "redundancy" and make viewers more likely to remember both the data and the larger message.

Doumont says that the team's conclusions align with many accepted guidelines in the visualization community.

"Studies like these are reassuring, in serving as empirical proof of why these ideas are so effective," he says.

How the researchers did it

The team analyzed subjects' eye movements, memory performances, and textual responses as they looked at a collection of nearly 400 distinct visualizations taken from newspapers, blogs, scientific journals and government reports.

Participants were first shown each visualization for 10 seconds, and then given a memory test to determine which ones they recognized. During these "encoding" and "recognition" phases, the researchers simultaneously collected data on eye fixations to help determine which elements of the visualizations were helping the subjects recall information.

Importantly, the team then showed participants blurred versions of the original visualizations and asked them to write down everything they remembered about each of them.

"A key insight was to break memory down into these three core cognitive principles of encoding, recognition, and recall," Borkin says.

"This allowed us to tease apart what it is that makes a given visualization not just more memorable than another, but also what a reader can actively recall in detail, which is a much more accurate measure of its effectiveness."

Borkin says the team is also releasing MassVis, the first open-source visualization database of its kind, to let others build on top of their work.

The dataset includes thousands of intricately-labeled visualizations, with metadata that includes memorability scores, eye movements, and user-generated descriptions.

The team is now working to further disentangle the different ways to define and measure memorability, as well as exploring how their conclusions can be applied to larger groups and people with specific areas of expertise.

More information: Beyond Memorability: Visualization Recognition and Recall. [vcg.seas.harvard.edu/files/pfi ... ission251-camera.pdf](http://vcg.seas.harvard.edu/files/pfi...ission251-camera.pdf)

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