Essay for NAGT Visualization Workshop
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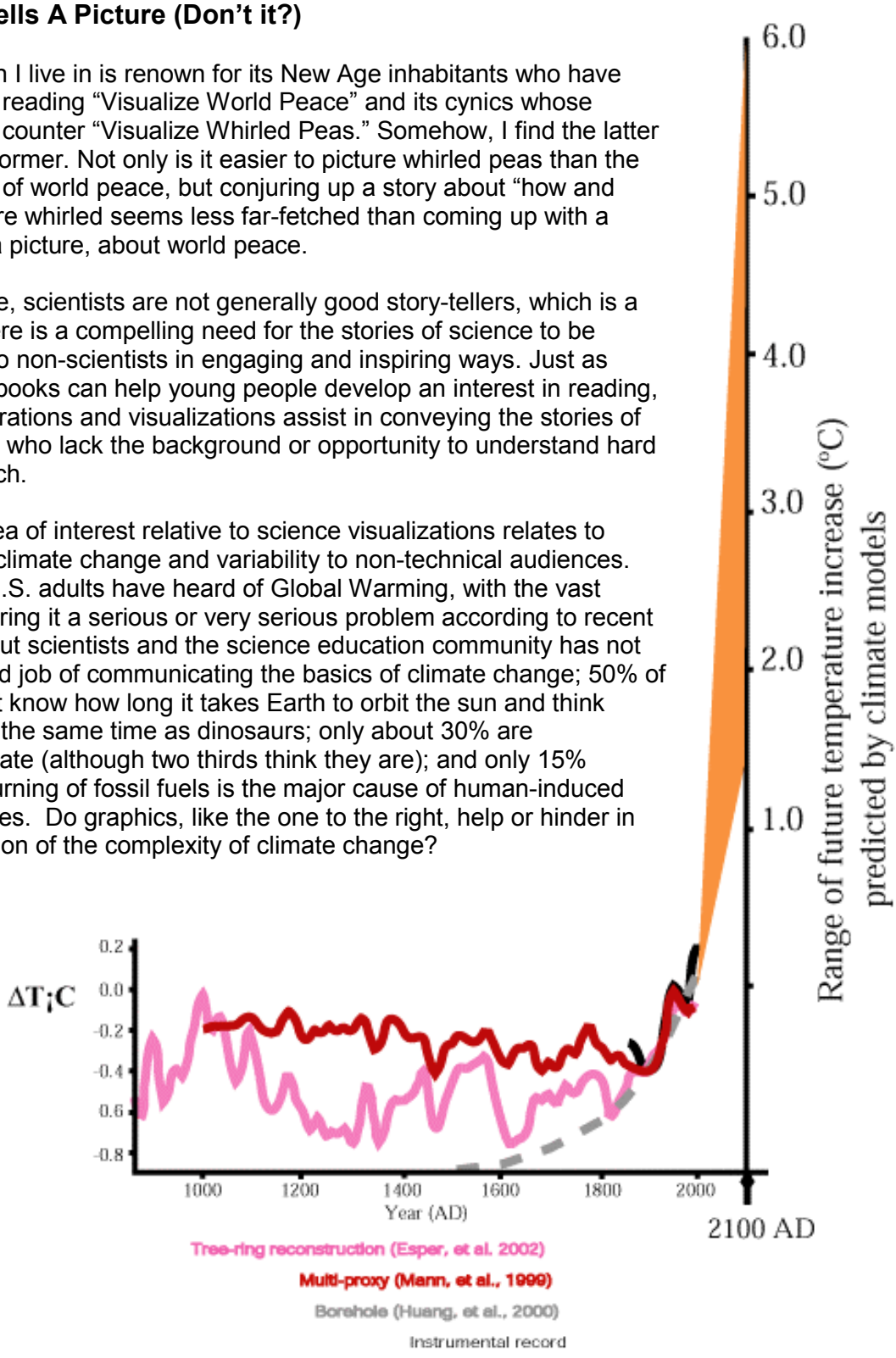
Every Story Tells A Picture (Don't it?)

The college town I live in is renown for its New Age inhabitants who have bumper stickers reading "Visualize World Peace" and its cynics whose bumper stickers counter "Visualize Whirled Peas." Somehow, I find the latter easier than the former. Not only is it easier to picture whirled peas than the nebulous notion of world peace, but conjuring up a story about "how and why" the peas are whirled seems less far-fetched than coming up with a story, let alone a picture, about world peace.

In my experience, scientists are not generally good story-tellers, which is a shame since there is a compelling need for the stories of science to be communicated to non-scientists in engaging and inspiring ways. Just as illustrated story books can help young people develop an interest in reading, so, too can illustrations and visualizations assist in conveying the stories of science to those who lack the background or opportunity to understand hard data and research.

My particular area of interest relative to science visualizations relates to communicating climate change and variability to non-technical audiences. Nearly 90% of U.S. adults have heard of Global Warming, with the vast majority considering it a serious or very serious problem according to recent NSF surveys. But scientists and the science education community has not done a very good job of communicating the basics of climate change; 50% of U.S. adults don't know how long it takes Earth to orbit the sun and think humans lived at the same time as dinosaurs; only about 30% are scientifically literate (although two thirds think they are); and only 15% recognize the burning of fossil fuels is the major cause of human-induced greenhouse gases. Do graphics, like the one to the right, help or hinder in the communication of the complexity of climate change?



Clearly, there is a huge gap between scientists studying past, present and future climate variations and the rest of the universe. In the U.S., some of the gap can be pinned on the media, which due in part to the power of the energy lobby tends to frame climate change as controversial and theoretical. (This is not the case in other parts of the world.) Some of the gap may also have to do with Americans' famously short attention span making it particularly difficult to convey scientific uncertainties and unknowns. Guilt about being responsible for more-than-out-fair-share of impact on the climate and environmental systems may also have triggered some degree of denial in the United States. But some of the gap in our collective climate change consciousness can be linked to the ineffective ways that scientists communicate, particularly with non-technical audiences.

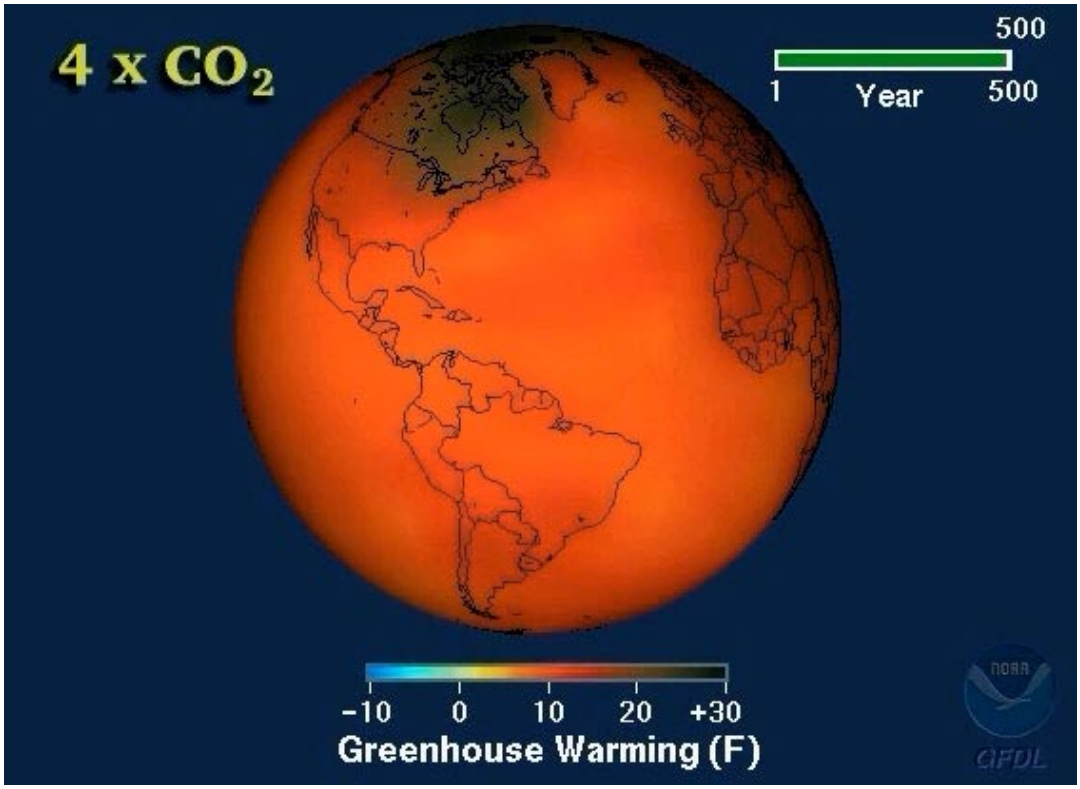
One of the problems that some scientists run into is that, in wanting to maintain an aura of "objectivity" above and beyond the messy details of politics and policy and avoid being labeled as "advocates", they simply don't bother communicating with non-technical audiences. Institutional pressure to "not rock the boat" can perpetuate this. But even when they communicate with each other with experts in their areas of expertise, scientists are often less than effective. When it comes to communicating with non-technical audiences (i.e. the vast majority of people), scientists often fail to know their audience or meet them at their own level. Moreover, in general scientists aren't skilled at storytelling nor at using effective visualizations and illustrations to communicate with the general public.

The proliferation of PowerPoint is also in part responsible for the communication conundrum. When it comes to presentations to peers and non-scientists, the medium of choice tends to be PowerPoint presentations which, according to Edward R. Tufte in his article "PowerPoint is Evil," "elevates format over content, betraying an attitude of commercialism that turns everything into a sales pitch." At professional meetings such as AGU, scientists model bad PowerPoint presentations to each other, often trying to zoom through thirty or forty slides of data visualizations in fifteen or twenty minutes. The graphics are often difficult to see due to the low resolution of PowerPoint, and complex ideas are often reduced to bullets. All too often, the PowerPoint slides are jammed with text, which the presenter then reads, word for word. No wonder many people are turned off by the dryness and complexity of science!

In a little National Academy booklet entitled "Communicating Uncertainties in Weather and Climate Information" (NAS, 2003) the authors examine several case studies in which weather and climate information was not-so-successfully communicated. One of the case studies relates to the National Academy responding to the White House's fast track request for a summary of scientific understanding of climate change in 2001. A report was pulled together in less than a month, resulting in President Bush's "Rose Garden" speech in which he admitted climate change is happening due to human activity, but that there are huge uncertainties that still need to be addressed. One of the "lessons learned" by the Academy was how important communication is, particularly with a topic like climate change:

> If part of the goal of a scientific endeavor is to communicate the findings to the public and policy makers, then the charge and findings should be written with that audience in mind from the start. Dissemination should not be an afterthought. Executive summaries and press releases are helpful, but lay language should not be confined exclusively to these documents. (37)

Clearly, part of such communication should include graphics and other effective ways of helping people visualize the findings. But how effective are graphics, like the one below from an animation developed by the NOAA Geophysical Fluid Dynamic Laboratory for a Whitehouse briefing on climate change in 1997? (Animation shows one model's projections of surface temperatures if carbon dioxide levels increase four-fold beyond modern (1997) levels.)



Over the past decade, a paradigm shift has been occurring in the ways people construct knowledge, driven in part by the advent of the Internet. Memorizing and repeating information is "out" and being able to access and use information is "in." This shift has profound implications for not only formal education, but also in providing the tools and support for "decision support" to diverse audiences. In the case of communicating the basics of climate change and providing tools and visualizations that can help people understand and plan for climate change and related socio-ecological dynamics, there is a compelling need to develop a new generation of materials and strategies that effectively meet users needs.

Climate change is perhaps the ideal interdisciplinary theme to weave together mathematics, sciences, ethics, philosophy and social discourse. Yet, making this a national or, better yet, international educational priority will require a degree of leadership and commitment that is currently lacking. If such leadership ever emerges, it will need to harness stellar visualizations and consummate storytelling from the scientific community in order to bridge the gap between the climate research science and the rest of the universe.

References

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