

Breaking the Myth: One Picture is NOT (Always) Worth a Thousand Words

Chair

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Panelists

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Abstract

We need to understand well both the power and frailty of images (e.g., compared to words) to be able to use effectively new visualization and computer graphics technologies in science, education, entertainment, and life and most importantly in the Internet's World Wide Web. The panel and the audience will discuss and debate the weaknesses of images including the difficulty in representing information clearly, the dependency of visual and information perception on past memories, experiences, beliefs, and culture, and the difficulty in making effective use of color.

"One picture is worth a thousand words" — Fred R. Barnard¹

"But words are words" — Shakespeare, *Much Ado About Nothing*

"...words are images of thought refin'd" — John Keats, *O Solitude!*

Introduction

Recent developments of computer visual display hardware on one hand and computer graphics and visualization methods and software on the other have generated new interest in images and visual representations. It is now possible with a "flip of a button" to generate visual depictions of data and information or to take existing images and modify them at ease. This renaissance of visual representation has highlighted the notion of the power of images.

"One picture is worth a 1,000 words," goes the popular saying. People in the graphics and visualization community have perceived it to mean not only that images could portray anything that words can, but that images could do it better than words. For example,

- Images are more powerful than words.
- One could pack more information into a given space using images than by using words to describe the same information.
- Images can convey information that words cannot (e.g., we need to define concepts before we are able to express impressions with words). In that sense, John Berger noted that "Seeing comes before words. The child looks and recognizes before it can speak" (Berger, 1977).
- Images can also deliver information more quickly and efficiently than by using words (these known facts have not gone unnoticed by advertising organizations and the like).
- Words could be fuzzy. Images show the truth as it is.

However, images may have some disadvantages and words are sometimes more effective (or powerful) than pictures. To use images effectively in science, education, art, and life in general, we need to understand the power and frailty of images. We need to understand when they are equivalent to words, when they are more appropriate to represent information than words and when they are not. This issue has become extremely important with the spread of the World Wide Web (WWW) where many document authors use graphics inappropriately not knowing, for example, when to put in an image and when to express an idea with words.

One of the problems is that computers representing abstract (e.g., non-numerical) information and visual computing and display are both new media. The understanding of the characteristics, advantages, and disadvantages of these new media is crucial to their optimal and effective use. This will take some time, however.

In the same token, we need to stop relating to the new medium of visual computing and display as if it were a replica of paper. This new technology allows us to do certain things beyond what is possible with paper and we need to understand the differences between traditional and computer generated images.

This panel and the audience will discuss and debate situations where images (both traditional and computer-generated) do and do not convey information effectively or correctly and where images and words could complement each other.

Panel Statements

A Picture is Not a Picture is Not a Picture...: A Picture Could be Worth a 1,000, 1/1,000, or -1,000 Words
Nahum Gershon

The difficulty in representing information clearly, the dependency of visual and information perception on past memories, experiences, beliefs, and culture² and the difficulty in making effective use of color are some examples illustrating the frailty of image representations. To make full and correct use of what display, graphics, and visualization technologies can offer us, we need to take these considerations into account when generating images or when viewing them. It is true, however, that for certain purposes, images do not need to portray reality exactly. But, we need to make sure in these cases, the viewers are aware of this fact deep in their minds. Otherwise, we might create pictures that are worth 1/1,000 (Hanson, 1970) of a word or even -1,000 words.

We need to make sure that people understand that not everything could be put effectively in a visual form. An example is the term text visualization. People usually imply that images could always represent effectively all the information contained within a collection of text documents and that it is much easier to get this information from images than from words. Is this really possible? If yes, why was language created, why did silent movies contained textual information, and why was sound introduced to film?

The Shibboleths of Pictorial Elites
Robert Braham

The shibboleth, in its original meaning, was nothing more than a single graphical sign (a word in Hebrew) used as a military password/ "passgraph." An enemy user of that graphical sign was caught when even though interpreting its place in the graphical system rationally, he lacked a crucial bit of knowledge about the ambiguities of the graphics known only to the other side – the pictorial elite.

Pictorial elites, even if more well meaning, are now springing up with alarming rapidity, aided by the tools of computer graphics. Basics of semiotic analysis, such as the ramifications of symbolic, indexical and iconic signs, were developed decades ago in linguistic theory but are powerful concepts for understanding graphics and their power to shape and be shaped by graphic communities.

Using these and other analytical tools, we would do well to compare the graphical/cognitive turning points we are now going through with those that parallel them in earlier times in the West. In the following cases, oral communities – word users – confronted radically new graphics technology, and to lesser or greater extents became text communities. In their time, as in ours, any comprehensive iconology must recognize the transient and interdependent relations of meaning.

graphical sign, and the technologies that inevitably alter those relations: the composition of epic poetry, the 12th century gloss, the Renaissance "rebirth" of 3-D projection, the change from scroll to pamphlet to book, medieval memory technique, and early scientific diagramming. The history of the earliest notations for Western music, devised for so-called Gregorian chant — an oral communicative system par excellence — holds a particularly interesting position in this light.

Towards Image Understanding³
David Fracchia

The phrase "One picture is worth a thousand words" has become cliché in our vernacular. Part of the reason we say it is because we assume that, to quote another cliché, "seeing is believing." That is, as we look around our world, we perceive it at face value as reality. In contrast, while we may acknowledge that words, particularly poetry, may bring to mind multiple images, it is not common place to claim that a phrase is worth a thousand pictures. The ambiguity of multiple personal images that arises from verbal communication means that we as a culture do not automatically believe words.

To compensate, our educational system focuses on verbal literacy allowing us to express ourselves precisely as in mathematics or evocatively as in poetry. In fact without verbal ambiguity we would lose much of our humor and pleasure in language. Unfortunately, there is no parallel education in visual literacy. While this may not have been a critical issue in the past, now with the advent of advertising, trick photography, and computer graphics we have the potential for creating visual ambiguity. This puts our whole culture at high risk of being fooled by what they see.

As disturbing as this may sound, the extension of humans' propensity to introduce ambiguity into visual images is a healthy indication of the maturity of visual languages as a communication medium. In fact, we revel in being able to create visual forgeries. What is needed now is to parallel the development of visual language with the exploration of visual literacy.

If we simultaneously want to be able to generate images for our amusement and for information dissemination, we need to understand how pictorial ambiguity arises. We know from work by people such as Bertin, Goodman, Laursen, Tufte, and Ware, that these problems can arise in most aspects of visual representation. It has been suggested that before we can disambiguate images, we need to discover the basic components of visual language. However, exactly what these would be is unclear, particularly in the case of computer images. It is possible that our real clues will come from graphic design and/or perceptual psychology.

Different Media Means Different Messages
Andrew Glassner

Words and images speak to different parts of our experience. Both can be primal or abstract, direct or vague. But novels and paintings are not interchangeable: a poem is not a child's finger-painting. These media are complementary, and neither identical nor antagonistic. Artists can combine these languages to produce interesting and meaningful work, but this composite is yet a third form, and does not subsume or replace the others. Words often fail to describe images, but images just as often fail to capture what can be said by words.

A Picture May Be (Or May Not Be) Worth A Thousand Words: Lessons From The WWW?
Barbara Mones-Hattal

A picture may be worth a thousand words, but those words may not be the same from one person to the next. It has always been a challenge for the artist to design with simplicity, subtlety, and sensitivity. The integration of text and image is not new to the artist. The emergence of the World Wide Web, however, has made for unusual and distinctive design issues. A certain urgency has emerged in order to further refine these relationships as on-line design becomes big business. The WWW is becoming a more effectively design multimedia tool. With it becomes even more important for us to realize when to use text or graphics or a combination of the two in order more successfully utilize this new venue.

Studying the WWW affords us new opportunities to gather enormous amounts of information about successful and less successful design strategies. The design and implementation of icons, the use and overuse/misuse of backgrounds, the potential for audio, 3D and interactive 3D have led to both unique and creative spaces and confusing and/or boring ones. An initial concern about bland and limited design options has replaced itself with new and potentially more exciting ones. However, it becomes important to start to discuss and identify what "successful" web design might mean so that we may be more able to both recognize and utilize these spaces with greater confidence.

P1000: A Picture is Worth 1000 Words
Russ Rose

In this era of the information explosion, there exists the need to take advantage of the power provided by the human's visual processing system. Visual exploitation will help in understanding the content of the vast uncharted mountains of information as well facilitate meaningful analyses of that information. Hence, visual representation of the information can be a powerful enabling force relative to improved understanding.

A picture is worth 1000 words; that is, in 1/1000 the time, a visual image can be processed and analyzed rather than being represented and processed as words. If represented as words, it would often require more than 1000 words, would take 1000 times as long to understand, and would still not communicate the content as comprehensively as a visual image can. The visual representation of the information, however, must be based on a comprehensive and information rich structure. If not, it will easily not be worth a single word, let alone the 1000 words (we all have sat through tiring briefings centered around charts cluttered with information-free clip art that provides no more than visual noise). Progress must continue, and be accelerated, in the area of visual representation of information. This progress will only be made through significant commitment of resources as well as the focus of intellectual energies for the long term.

Biographical Information

Robert Braham

Robert Braham is Senior Associate Editor of IEEE Spectrum, which is published by the Institute of Electrical and Electronics Engineers and is the world's most widely read magazine on advanced electrotechnology and applications. At Spectrum he is specifically responsible for all areas of computer graphics, human-computer interaction, artificial intelligence, multimedia, military technology, and robotics.

F. David Fracchia

F. David Fracchia is an Assistant Professor in Computing Science at Simon Fraser University, Co-Director of the Graphics and Multimedia Research Lab, and member of the Centre for Experimental and Constructive Mathematics. He received a B.Sc. in computer science from the University of Regina, an M.Math. in computer science / combinatorics from the University of Waterloo, and a Ph.D. in computer graphics from the University of Regina. He was a post-doctoral associate in the Mathematics Department at Yale University with Prof. Benoit Mandelbrot's fractal group. His main area of research is the visualization of cellular growth in plants and animals, although he has published articles dealing with the visualization of archaeological dwellings, philosophical logic, fractals, and large information spaces. Dr. Fracchia is a member of IEEE, ACM, and ACM SIGGRAPH.

Nahum Gershon

Nahum Gershon is a Principal Scientist at The MITRE Corp. His work is concerned with data and information visualization, network browsers, image processing, data organization, and analysis of medical, environmental, and other multidimensional data. He pursues research in the use of understanding of the perceptual system in improving the visualization process and dealing with information. He has received his Ph.D. from the Weizmann Institute of Science and has held positions at the Massachusetts Institute of Technology, Johns Hopkins Univ., and the National Institutes of Health. Nahum was a Co-Chair of the IEEE Visualization Conferences in 1994-1995 and co-organized the first Information Visualization Symposium in 1995. He serves as a member

of the Advisory Panel of the Earth Observing System Data and Information System (EOSDIS) and the US National Research Council's CODATA National Committee and was a member of the Focus Group on Visualization and Presentation of the White House's GLOBE Program.

Andrew Glassner

Andrew Glassner is a researcher at Microsoft Research, where he studies issues in computer graphics and the social implications of computers. In addition to many technical articles, he has authored or edited many well-known graphics texts, including *Principles of Digital Image Synthesis*, published by Morgan Kaufmann. He is currently Editor-in-Chief of *ACM Transactions on Graphics*, and serves on the editorial board of *IEEE Computer Graphics & Applications*. He also writes fiction, plays jazz piano, and enjoys painting and hiking. He holds a Ph.D. from University of North Carolina at Chapel Hill.

Barbara Mones-Hattal

Barbara Mones-Hattal, an artist and educator, is affiliated with Pacific Data Images (PDI) and is an Associate Professor of Art and founding Director of the Visual Information Technologies Program at George Mason University in Fairfax, Virginia. In addition to her responsibilities for the MA/MFA program, a Computer Imaging and Animation program that specializes in electronic and digital media technology (including on-line design), she serves on the faculty of the Institute of the Arts. She is also a member of the faculty for the Center for Computational Statistics and Institute for Computational Sciences and Informatics. Since 1984, she has been very active in ACM SIGGRAPH including the Special Projects Chair of the Education Committee Art Curriculum Chair and a Juror for the SIGGRAPH 95 Art Gallery.

Russ Rose

Dr. Russell Rose has been assigned to the Office of Research and Development since 1981, where he has served both as a manager and as a research scientist in the areas of information processing and analytical methods. In the broader Intelligence Community, Dr. Rose is a member of the Advanced Information Processing and Analysis Steering Group (AIPASG), whose goal is to improve the information processing environment of the intelligence analyst. Dr. Rose served as Executive Secretary of AIPASG from 1991 to 1995. From 1993 to 1996, Dr. Rose has been chair of the Intelligence Community's P1000 Visualization Program whose goal is to extend the use of the visualization sciences and technologies for exploiting the brain's visual system in improving the analytic environment. Dr. Rose is also a member of the Intelligence Community's Modeling and Simulation Coordinating Group whose principal objective is the coordination and exchange of modeling and simulation technologies within the community. In these community roles Dr. Rose has also chaired the 1992, 1993, 1994, and 1995 AIPA Symposia and the 1992 Intelligence Community Modeling and Simulation Symposium, as well as the 1994 and 1995 Community P1000 visualization workshops.

Prior to joining the government, Dr. Rose had a background in university and in public school education in the areas of mathematics and computer science. This experience included University of Pittsburgh; University of Texas; Austin, Texas schools; and Arlington County, Virginia. Dr. Rose also served in the United States Army Southern European Task Force, as an Army Officer. Dr. Rose grew up in the coal and steel region of western Pennsylvania. He received a Ph.D. from the University of Texas at Austin, Texas, and a M.Ed. and a B.S. from Indiana University of Pennsylvania, Indiana, Pennsylvania.

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Footnotes

1. From *The Home Book of Proverbs, Maxims, and Familiar Phrases*, Burton Stevenson, ed.: The first version of this quote is "One look is worth a thousand words." Fred R. Barnard in *Printers' Ink*, 8 December 1921, p. 96. In *Printers' Ink*, 10 March 1927, p. 114 he changed it into "One picture is worth a thousand words" calling it a Chinese Proverb so that people will take it seriously (information taken from *Familiar Quotations*, John Bartlett, 16th edition, Little Brown and Company, Boston, 1992).
2. The potential fuzziness of information representation by images is in part a result of visual perception being based on "making the best bet on the available evidence" (Gregory, 1990). This bet making process takes into consideration not only information contained in the images themselves but also our memories, experiences, beliefs, and culture.
3. This statement is derived from research being conducted in collaboration with M. Sheelagh T. Carpendale at Simon Fraser University.