Visual Communications, Past and Future

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Abstract

People acquire most of their information through their visual system. Moreover, people often quote that "a picture is worth a thousand words" and it is well known that color attracts attention and helps communicate. Nevertheless, most of our documents are primarily black and white text! This talk reviews the history of visual communication, proposing the thesis that technology, both its advantages and its limitations, has distorted our document design and preparation. Technology is now reaching the point where color and illustrations can be included in many documents, and professionally prepared magazines, newspapers, etc regularly do so. The technology still needed for the future is that which will make it as easy to produce a color illustration as it is now to type a paragraph. This development will require both improved man-machine interfaces and teaching the average person new concepts of document design.

Background

If we look at pictures taken from caves, we see that cavemen probably understood more than we might have suspected about communication. Although they had no written words, they apparently knew enough that, when one examines cave pictures, we see that they often drew black outline drawings, then filled solid areas with color. This technique, now known as cartooning, takes advantage of the fact that the human visual system is very sensitive to sharp transitions in luminance, but only sees color in broad areas. That is, the human modulation transfer function (MTF) extends to high spatial frequencies in luminance changes, but the MTFs for the color difference channels fall off quickly at low spatial frequencies. Obviously, the cavemen would not have described the phenomenon in these terms, but they apparently understood enough to use the effect.

This paper concentrates on trends in recorded information. For the most part, we will mean documents on paper, but the caveman example clearly pre-dates paper, so the cave walls are the best we have. We avoid referring to these documents as "the written word", primarily because that expression might be considered as much of a problem as it is descriptive. It is unfortunate that documents have become almost synonymous with words; communication can be so enhanced by the inclusion of color and illustrations.

Technology now enables color and illustrations to a great degree in most of our documents. Nevertheless, some economic restrictions still bind us. For example, in the "Author's Guide for PICS Conference Book", it states "… keep in mind that the book will be printed in black & white, …". Thus, for example, there was no point in trying to show the color cave picture; words had to describe it. In general, this paper will contain no color and less illustrations than would be optimum. We can hope that a few more years, and the work of a number of technologists, will obviate the need for such an apology.

Use of Illustrations

If one looks at well designed documents, it is apparent that color is primarily important in illustrations. Illustrations can communicate faster, and often better, than words alone. For example, road signs are being converted to use standardized graphic symbols instead of words. Fig.1 shows a new, international sign and the old word sign for "no left turn". The new sign can usually be understood faster, at a greater distance, than the one with words. Moreover, the new symbols are international, so you do not need to understand the local language. (Note that the international symbol is also red, but will not show that way in the book.)

Figure 1. New and old road signs

Consider someone giving you directions. Would you rather have words or a map? Words help to describe what is not shown on the map, but unlike words, the map remains useful even if you get off the preferred route. Most word instructions fail to allow for that contingency.

Technologies, Past

Until movable type was invented (actually, until it was re-invented where a short alphabet made it practical), books were mostly illustrations, with some text. Quoting

Compton's[1]: "Before the invention of movable type, small religious books were printed in Europe from engraved blocks of wood. Each block was the size of the page and consisted usually of a picture with a small amount of descriptive lettering beneath it. These books are known as block books and the method by which they were printed is called xylography as contrasted with typography, or printing from movable type."

Note how books changed after movable type came into use. Suddenly, books were mostly words. Making an illustration was no harder than before, but making text was now much easier. Also, printing plates changed and it actually became a bit harder to get the illustration to the plate. Text was becoming the technologically preferred communication tool and illustrations became less frequent.

Pictorial illustrations were helped to a degree by the invention of photoengraving (1824) and halftones (1852). But the first newspaper with pictures appeared in 1880.

About that same period, a practical typewriter was invented. That is definitely a word oriented device. What movable type did for printed documents, the typewriter did for offices. Now, an office worker could make small numbers of text documents and with carbon paper, distribute small numbers of copies.

Over the next several decades, although a few copying machines came on the market, originals were typed and copies were usually done with carbon paper. About 1960, the Xerox 914 copier revolutionized office copying. As ever faster copiers were produced, the number of copies of documents rose rapidly. The office converted from making originals and a few copies to a microcosm of the printing industry.

It is interesting to note another effect of the office copier. Until very recently, almost all those copiers were black and white. Thus, even what little color was used to communicate in office documents was quickly eliminated. Financial accounting had long used red ink, then red ribbons in typewriters, to show negative financial results. With the general usage of office copiers, companies no longer went "into the red"; rather, they went "into the parentheses." This is perhaps one of the clearest examples of long standing methods of communication being restricted by the use of a new technology. (Please do not get the impression that I think movable type, copiers, etc, caused deterioration of communication. Overall, they were great advances. Nevertheless, they had some negative impacts that we now have a chance to correct.)

Technologies, Present

Rapid advances in computer technology have almost replaced the typewriter. The office copier and the digital printer are becoming similar, often based on identical technology, differing mostly in a few interfaces. The Author's instructions for this conference say "Please provide a digital version …". An author without a computer apparently no longer exists.

Has this now created an environment where everyone communicates optimally? Hardly.

Most of the technology is available. A large majority of computers, even in homes, have color monitors and many have color printers, dominated by ink jet technology. However, as illustrated by this Proceedings, color printing is still not quite economical in the reproduction of a few hundred copies. In small numbers, as noted above, color ink jets are economical. In large volumes, color printing is quite common (magazines, newspapers). The economics of color printing at intermediate volumes will be solved soon.

Some will say that it is still difficult to get the colors they want. Colors on the monitor do not match colors on the print. But color management problems are yielding to technology. Papers at conferences such as PICS show that the science is mostly understood and the engineering is advancing. Standards are being adopted across the industry.

Likewise, the image processing needed to handle photgraphed, scanned and created illustrations is at a state where they do not interfere with the use of practical illustrations.

What, then, remains as barriers to the more frequent use of illustrations, as one would expect for best communication?

Technologies, Future

This paper suggests that two things are still needed to help enhance communication. First, the keyboard and mouse are unlikely to be the best interface for creation of illustrations. Second, a number of generations of people have been taught to communicate by writing words. The average person today knows little more than the cavemen about the correct way to use illustrations to help communicate efficiently.

Figure 2. Is this the right way to create illustrations?

We do not attempt to suggest the correct interface for creating illustrations. It is doubtful that a keyboard and mouse are the correct answer, although it is possible. Work is needed not only on the physical interface, but on the logic of what is to be done. Does one want easy ways to assure, for example, that lines are straight? Or, should one start from something like clip-art of a similar illustration and have easy ways to modify to what one wants? Or, most likely, something entirely different.

Second, we need to educate the general public in the use of illustrations. As technologists, our main input needs to be on what to teach. Perhaps a good answer to the first question above will be enough to spur the use. For generations, people in school have been asked to create, for example, a 500 word composition. That trains them to use

words. We need the equivalent for illustrations. Should people be asked to create a document with 500 words, three illustrations, at least one being a picture? Some schools are starting to do such things. But this question needs to be attacked after the previous one; people will not respond well to using illustrations as they should until it is easy to do it right.

Conclusion

If you are like most people, the first thing you looked at in this paper was the illustrations. You would have been even more certain to do that had the illustrations been printed in color. That is because you inherently know that these will normally give you the most information in the shortest time. You use the quick glance to tell you whether to bother to read the words.

By examining some historic trends, we see that technology has helped overall in documented communication, but it has also had the side effect of turning us away from some of the most effective communication methods. We are now approaching the point where we can remedy those effects, if we decide it is important to us.

References

1. Compton's Interactive Encyclopedia, SoftKey Multimedia, Inc., 1997 Edition, Book and Bookmaking.

The following slides (pages **345a** through **345aa**)
were used in the presentation of this paper.