Design Systems and Their Link to Prepress

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Abstract

This paper covers the evolution of design system technology and its use in the design segment of the graphic arts industry. Technical requirements for design technology for print are highlighted. The presentation also explores the technical issues involved with developing a digital link between design systems and prepress.

Design Systems and Their Link to Prepress

Before beginning this discussion on electronic design systems and how digital links can be developed between these and color electronic prepress systems (CEPS™), I would like to place this entire discussion within a much broader context. While the development of digital links between design and prepress systems is one of great importance to the graphic arts industry, it is important to note that this is just one component of a much larger integration process. This larger integration process, Electronically Integrated Publishing (EIP), is one that seeks to provide the graphic arts industry with digital tools and standards that will support its high degree of diversity and segmentation.

DTI has been discussing the issues involved with developing Digital Data Exchange Standards (DDES) for the graphic arts industry since 1985. This year is no exception, as you will note from Dr. S. Thomas Dunn's presentation, *Digital Data Exchange Standards (DDES) for Graphic Arts - An Update on Technical Developments*, contained later in these proceedings. Because of this I won't go into a great deal of detail on standards developments except to say that this will play an important role in our industry's ability to develop links between design and production systems. In a much broader sense the standards issue is one that is pivotal to the graphic arts industry's ability to reach its goal of obtaining true EIP.

Background

A decade has past since I first started looking at computerized design systems. Perhaps it would be accurate to say that at that time I started to look at computerized systems with the hope that they might become applicable to the needs of graphic designers. Despite the fact that Ivan Sutherland had demonstrated his famous "SketchPad" graphics interface in 1965, and one of the world's first computer graphic images was displayed on a monitor using frame buffer technology at Xerox Palo Alto Research Center (PARC) in 1973, ten years ago was still part of an era in which computer technology remained the almost exclusive tool of science and engineering.

Times have certainly changed. Today's market contains a profusion of computerized systems aimed at graphic design. Some of these systems have been developed with a great deal of understanding and thought brought to bear on the application to which they are intended. Others do little more than display "pretty pictures" on their monitors. Though it is important to note that while we now have "design systems" on the market, the underlying technical requirements for these systems has not changed.

When I speak of design systems, I am speaking to their particular requirements as a tool within graphic design. Specifically, I mean graphic design for the print medium. During the late 1970s to mid 1980s, design systems became quite popular as a tool within other forms of media. Everything from presentation graphics to video and cinemagraphic animation began to successfully employ computerized tools. Why then has the print medium been such a hold out? Some have said that the reason lies somewhere within the graphic arts industry's comparatively long history of art and craft, and the conservative nature one finds therein. The less kind might claim that it has something to do with the fact that the graphic arts industry is still hung up on something as "archaic" as a printing press for an off-line output device. Both perspectives unfortunately overlook some of the fundamental technical and structural requirements of the graphic arts industry. The fact remains, however, that of all media the technical challenge presented by print is one of the most demanding. But that of course is what also makes it one of the most interesting.

Data Types and Issues

There are two fundamental data types (e.g., rasters and vectors) that computerized systems specialize in handling. Unfortunately, most computerized systems specialize in handling one or the other. The graphic arts industry, however, often has a need to print both, intermixed, on one page or within one document.

Vector data can be thought of as a sophisticated form of connect-the-dots from the manner in which it is specified and handled within the computer. Items such as positioning or layout information, rules, borders, tints, shrinks-and-spreads, are all examples of vector data. Outline type is also vector data. However, there are a number of unique issues of type that will be discussed later in this article.

Raster data would be items such as scanned line art and/or photographic images. Obviously print uses a lot of both, and that is one of the things that has made the print medium such a challenge for the systems developers. Raster data for print is very data-intensive. One 8-1/2" x 11" four-color bleed image takes up about 32M bytes in a computer system. Vector data is comparatively much less data-intensive, typically 10 to 30 kilobytes per page.

Other visual media, particularly television, do not have the same data-intensive requirement for pictures. Part of the reason for this is simply that the transient nature of the television image is perceptually much more forgiving than the static image that appears on the printed page, and due to limits in displays. Also, television technology uses much smaller raster files (less than 750 kilobytes).

The Myth of Device Independence

Like most myths the concept of "device independence" once actually had a specific meaning within a specific context. The term appears to have originally been coined by Jim Warner, President of Precision Visuals, in 1982. At that time Precision Visuals was in the business of developing and selling software that allowed digital data to be transportable across a variety of computer graphics devices – hence the term "device independence". This work pre-dated the development of digital exchange standards within both the computer graphics and the graphic arts industry. It is important to note that in obtaining "device

independence" the data was able to move from one system to another; however, the "quality" of the final image was dependent upon the actual quality of the data *and* the capability of the output device. This remains true today.

Claims of resolution and device independence usually indicate that the data used to develop an image or page is transportable from one system to another. The resulting image, or page, is still dependent upon the capability of the output device. This is a particularly important concept for the graphic arts industry to understand, as the terms "resolution" and "device independence" have often been misconstrued to mean that one will get precisely the same final results independent of the capability of the output device. This is simply not possible. This difficulty is especially noticed with raster data.

Because the graphic arts industry does make use of that off-line output device known as the printing press, because of the different types of presses, because of the different line screen resolutions, because of a host of reasons unique to the graphic arts application, our industry has a need to be very specific about resolution, output device, and size.

If "device independence" means, as it originally did, having the ability to transport bits and bytes from one system to another then yes, the graphic arts industry is obtaining a degree of device independence through its development of DDES. If however "resolution and device independence" is confused to imply that one will get the same results from the data independent of what output device is used, then the graphic arts industry needs to beware. This form of "resolution and device independence" only works if you don't care about what the resulting output looks like.

Design System Requirements

Basic to computerized technology is that it is often successful in assisting with the automation of **known processes**. If a process is not well known or understood then it is difficult, to the point of being impossible, to emulate the functionality in hardware and software. The prepress segment of the graphic arts industry learned this firsthand during the early years of CEPS. Very often the vendors and the users learned together what functionality was required of these systems.

When it comes to design systems the first step is to look at what is done conventionally throughout the creative process. *Figure 1* illustrates the various subdivisions, services, and technology that we find within the creative segment of the graphic arts industry.

	Subdivision	Services	Technology
Creative	Concept Creation		Optical Disk Portfolios
	Art Selection and Preparation	Typography	Digital Typesetters
		Illustration	Synthetic Art Systems
		Photography	Digital Cameras
	Art Modification	Color Retouching	(CEPS) Color Electronic Prepress Systems
		2nd Generation Original	
	Art Assembly	Stats	Stat Cameras & Copiers
		Renderings	
		Mechanicals	Digital Keyline Systems

Figure 1

It is important to note that within the conventional world the "vector data" (e.g., the type, layout, and geometric art information) travels a separate path than the raster data (e.g., the pictures) as illustrated in *Figure 2*. With the exception of the images, the data that constitutes creative functions are vector data. Thus, for a variety of reasons -- not the least of which is that vector data is less data intensive than raster data -- design systems for the print medium could, and in many cases are, based on personal computers.

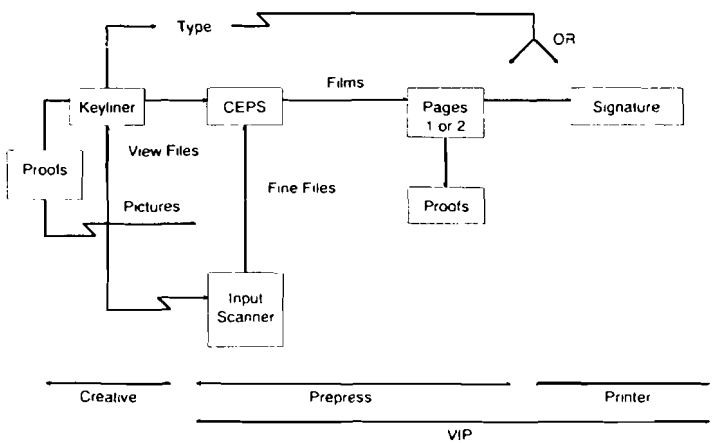

Figure 2

Naturally there is a desire to incorporate pictures on these systems -- an emulation, if you will, of the conventional practice of positioning a (low resolution) stat of an image on conventional mechanicals. Though one should not confuse these images with the images that are needed at the prepress production stage. The low resolution view files on design systems contain about one-tenth of the data found in the higher resolution fine files contained in prepress systems. These view files (e.g., the data required to display the image for *viewing* on the computer monitor) should be considered the computerized version of the stat. And, just as one would not generally use a stat as an original for prepress production, one should not use the view file as the data to drive prepress images. The problem of course is that one can visually see the difference between a conventional stat and an original color transparency. The visual difference between the view file and the fine file does not become evident until the halftone films are generated and proofed.

The principal reason why you don't want the fine file data on the design system is one of cost and performance (remember the 32M bytes issue). One exception to this is in the area of design systems for the photo-retouching application. The application of photo retouching has the highest resolution requirement of any within the graphic arts, even higher than prepress. The reason for this is that while prepress may have knowledge of the final line screen resolution and printed image size required, photo retouching is often not provided with this information.

Because of this, photo retouching must shoot for the highest resolution and size that it can achieve, or anticipate the actual usage. Though even when using today's CEPS for photo retouching the discerning eye of the retoucher will often detect a degradation in the dynamic range of the contone image that is output. *Figure 3* shows the type of computers that are being used within today's creative applications. It also notes some of the problems associated with current technology within the creative segment of the graphic arts industry.

Design Stage	Type of Computer	Problem
Thumbnails	?	Speed Interactivity Portability
Roughs	P.C. (Paint)	Interactivity Functionality
Comprehensives	P.C.	Representative Type. Two Page, Functionality
Mechanicals (Keylines)	P.C. (Layout)	Representative Type. Two Page, Price
Retouching	Image Processing	Price

Figure 3

The Type Issue

Any discussion of developing links between design and prepress deserves the inclusion of some special discussion on type. The problem is fairly straightforward: As things stand today you must have the same typeface on the production system as you have on the design system in order to achieve true "What You See Is What You Get" (WYSIWYG) results. If the exact same typeface is not on the production system as is on the design system then you will have problems with line endings, paragraph endings, and page endings not being the same. This in turn will affect the overall color (e.g., the relative placement and balance of type and white space) of the page. Needless to say, this result can and does make for some fairly unhappy designers and art directors.

While the concept of standardizing the type may sound good on its first pass, it's important to understand what is involved with this proposal. If one is suggesting that the typeface itself, and all of its attendant kerning, set width, and other information is standardized then we are looking at a world in which typefaces will pretty much all look alike, or else the

various designs will be corrupted in the process of being forced into a standardized spacing scheme thus defeating the initial work of the type designer. It is unlikely that typographers, designers and art directors will be pleased with this concept or its result.

It is important to remember that at the high end of the graphic arts market, art directors and designers in the conventional world have access to well over 18,000 different typefaces. And some will insist that they need this wide variety in order to achieve the variety of aesthetic results that they are called upon to develop for their clients. The sheer magnitude of this makes type a difficult problem in the design system area. This is further compounded by the fact that some of these typefaces have not as yet even been digitized. Obviously these issues make the concept of standardized type one that is difficult at best. However, recent trends and announcements lead the way to the possibility of multiple typeface libraries on production systems as well as design systems. This seems to be the only practical, although expensive, solution.

Linking Design and Prepress

It is our opinion that in order for successful links to develop between design and prepress we must first address the issue of having a design system that can emulate the functions currently found in conventional design methodology. Specifically, we feel that a design system for the print medium should be capable of handling mostly vector information; that the raster information for the pictures and scanned line art be maintained at view file resolutions; that the design system have type that is compatible with the production system(s); and that the design system is capable of developing and delivering digital mechanicals, hardcopy stats that in some cases may be color; and that the information be editable throughout the process, from design **through** production.

In addition, today's design systems need a standard means of communicating color information. Better market-niche specific software, that accounts for the various segments and functions within the creative process for print, also needs to be developed. Typefaces need to be compatible and transportable between design and prepress systems. Page description languages (PDLs) and organization need to be compatible and transportable between design and prepress systems. And finally, multiple means of transporting data from design systems to production systems must be devised.

One problem area of design systems that needs to be addressed is color control and communication. At the *1988 Electronic Design in Print* Conference, peer group designers universally said that they expected print quality color on their design system (either on the display or the color hardcopy output). This desire is unlikely to be satisfied in the next five years. This anticipation by designers must be dealt with, either by education in realities, color calibration of design systems, or print quality color hardcopy (otherwise known as lowcost DDCP).

That's a tall order. Fortunately, there are several developments that are assisting with the actualization of the above-mentioned requirements. Efforts to develop some form of typeface compatibility are ongoing within the computer systems industry. The development of a standardized color space is being addressed by both the graphic arts and the computer systems industries. This work is being carried out in part under the ANSI IT8 committee, in part by CGATS, and in part by the office systems industry through its work on the Office Document Architecture (ODA) color addendum. The SPS Association, which was formed at the 1989 *Electronic Printing Systems* (EPS) conference, is seeking to develop a standardized PDL, including standards for the color extensions to PDLs. And finally, the success of the ANSI IT8 committee, in its continued efforts to develop digital data exchange standards (DDES) for the graphic arts industry, remains central to the graphic arts industry's ability to not only develop links between design and prepress systems, but also to achieve electronically integrated publishing, across the prepress environment and from prepress to press.

Footnotes

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