
Visual Communications Journal 1999



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The *Visual Communications Journal* serves as the official journal of the International Graphic Arts Education Association, Inc., and provides a professional communicative link for educators and industry personnel associated with design, presentation, management, and reproduction of graphic forms of communication. Manuscripts submitted for publication are subject to peer review by the Association, and the views and opinions expressed herein are those of the authors and do not necessarily reflect the policy or views of the IGAEA.

Article submission

Submission of articles for review may be made throughout the year. Please refer to the manuscript guidelines found on pages 54–56 of this publication.

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Editor's note

All International Graphic Arts Education Association (IGAEA) members can be justly proud of this *Visual Communications Journal*. Two major changes were incorporated in this issue: papers written by students of IGAEA members are now accepted for publication in the *Journal*, and professional articles submitted by IGAEA members are now subject to a rigorous jury review process.

For several years, my goal has been to provide a forum in which students of IGAEA members may publish. I strongly believe that professors and instructors of graphic arts should go beyond the teaching of ever-changing technology and instill in their students a deep admiration of language and the ideas it can transmit. After all, printers provide a media through which language flows. However, it is important to remember that printers provide more than just the media channel. In fact, Don Piercy, Director of the Houston Museum of Printing History, stated “Historically, printers have had the responsibility of printing the truth and printing it accurately—including accurate grammatical construction.” To insure that ideas are accurately transmitted, printers and publishers have traditionally employed proofreaders to question and analyze content for grammatical construction, readability, and accuracy. Today’s technology does not eliminate printers’ responsibility: the accurate use of language is more important than ever.

The accurate use of language requires at least two skills: reading (literacy) and the ability to express oneself through words (rhetoric). Literacy is probably the more important of these skills and is considered by many, including Piercy, to be the foundation of freedom and democracy. Concerned printers, including Professor Harvey Levenson of Cal Poly San Luis Obispo, argue that literacy is essential to the future of the printing industry. Indeed, illiteracy makes printed products—and the people who print them—unnecessary. Unfortunately, the illiteracy rate is growing in the United States. That is why the Graphic Arts Literacy Alliance was formed.

Once individuals become literate, the next step is to learn to express themselves using words—both written and oral. Many students do not become

skilled users of language before they reach our classrooms. Some students may be semi-literate or functionally illiterate, while others may have difficulties expressing themselves clearly and accurately. We owe it to our students to help them be literate and to express themselves accurately using words. In fact, teaching the proper use of language is part of our heritage. Piercy contends that “In the old days, when people did not have money to send their children to college, they would apprentice them to printers so they could learn the English language. Significant among them were Thomas A. Edison, Marion F. Hershey, and Wilbur and Orville Wright.”

I applaud graphic arts instructors and professors who must literally force their students to write. They carry on the printers’ heritage of instilling the use of language in their protégés. This volume includes papers written by students of IGAEA members. They were reproduced as received: only the formats were changed to match the design of the *Journal*. I think you will be proud of those papers.

In past years, articles received for publication in this *Journal* were reviewed and accepted or rejected by the editor. However, beginning with this issue, professional articles are now subject to juried review. Each article (with the exception of the articles that were received after the due date) was reviewed by a panel of three objective jurors in addition to the editor. The reviewers voted to accept, reject, or request changes to each article. Articles that were judged to be inferior were rejected, while others were strengthened when writers incorporated the suggestions of the jurors. Overall, I am sure that the jury process improved the quality of this year’s articles. I am grateful to Ervin A. Dennis, Page Crouch, and Max Rabiee for serving as jurors this year. The authors and I appreciated their insight and suggestions.

Thanks to all those who wrote articles to share their knowledge with the IGAEA membership. Thanks also to those faculty who contributed their students’ work.



Preparing for a career in printing and publishing:

An open letter to advisors and students

by Dr. Cynthia Carlton Gillispie and Dr. Vincent W. Childress

Where are you going? Where do you want to go? Printing and publishing majors often fail to identify what they would like to do upon graduation. A student who spends four to five years in a graphic communication program that deals extensively with the use of graphic processes and techniques should identify and prepare for a particular job field. Unless students prepare themselves by wisely selecting major courses and electives, participate in relevant activities, and search out career information, they may experience difficulty getting a job and/or may need additional training. It is similar to the old aphorism, "If you are not sure where you are going, you will most probably end up in another place." Therefore, graphic communication students must research, plan, and specialize in appropriate fields of study as they take courses within the field.

Planning for related fields

The field of graphic communication is composed of several disciplines, industries, and technical fields. Many of these fields are very specialized and support the overall graphic effort. Students can greatly enhance their career potential by identifying a field in which they wish to work and by taking appropriate courses. It is incumbent upon the faculty advisor/counselor to continuously advise students about their career goals and the courses they should take. Early in their educational program, students must answer the question, "What do I want to do when I graduate?" The answer to this question will help the advisor suggest ways students can best prepare themselves to attain their goals. A student, however, will often answer the previous question with a question, "What options are

Prepress	Production	Management
Designer Digital prepress operator Desktop publisher Web page designer Multimedia author Screen printer Estimator Photographer Scheduler Computer animator Copywriter Editor Proofreader Color specialist	Offset press operator Flexographic press operator Screen printer Gravure press operator Folder operator Foil stamp operator Collator/stitcher operator Research and development	Marketing/sales representative Production manager Production supervisors (various departments) Quality control Human resources specialist Public relations specialist Account specialist Training specialist Technical representative Supplier Teacher (from Flecker & Groff, 1998; National Scholarship Trust Fund, 1997; and Education Council of the Graphic Arts, 1997)

Table 1: Career possibilities in graphic communication

available to me?" The answer is that there are many possibilities available, provided the students have properly prepared. Some of those possibilities are listed in Table 1.

Students can pursue many fields upon receiving a bachelor's degree in graphic communication with a concentration in printing and publishing. There is enormous potential in graphic communication, because printing, media, and related companies employ a wide range of personnel (see Flecker & Groff, 1998; National Scholarship Trust Fund, 1997; Education Council of the Graphic Arts, 1997). The coursework required to prepare for a given field within graphic communication depends upon the specific field. For example, a student interested in printing management as a career should

take courses in electronic imaging, data entry and manipulation, and print production. Students interested in writing text for printed pieces can be writers, copywriters, editors, proofreaders and/or public relations specialists. Flecker and Groff (1998), the National Scholarship Trust Fund (1997), and the Education Council of the Graphic Arts (1997) identify and describe the job titles mentioned above as well as those below.

If students are planning their education paths in particular directions, then they should consider adding additional courses to their programs of study as suggested in Table 2.

Graphic design and layout

A graphic designer plans the piece to be printed and establish-

es its mood and style. An illustrator creates drawings, charts, graphs, or full color artwork to complement written words. A page-layout artist uses a computer to design artwork and the text according to the designer's layout. Salary: \$30,000–\$60,000.

Production supervisors

Supervisors generally have managerial skills along with strong mathematical and mechanical aptitudes. Salary: \$30,000–\$65,000.

Sales representatives

Sales representatives are usually self-starters with excellent communication skills. They have the ability to understand and work well with people. Sales representatives have a working

knowledge of the entire publishing process and know how to sell all of the company's services to customers. Salary: \$30,000–\$100,000 and up.

Estimator

Estimators have knowledge of printing production and design. Estimating is a liaison position—one of the links between sales and manufacturing. The estimator provides the information that will help the salesperson bid competitively on a project. Salary: \$25,000–\$45,000.

Production manager/coordinator

Production managers or coordinators are responsible for normal operation of the design and

printing process. They are decision makers and implement company policy and plans for production and expansion. Production managers ultimately supervise most production personnel. Salary: \$40,000–\$60,000.

Marketing specialist

Marketing specialists work in public relations, advertising, or marketing. They are responsible for promoting the work of a company through the use of advertising campaigns, brochures, print, television, radio, and public appearances. Salary: \$35,000–\$60,000.

Computer animator

Computer animators work in

filmmaking, video game development, accident reconstruction, and multimedia. Other fields might include advertising, publishing, and business. After a general education in graphic communication, advanced training in a specialty school that offers animation courses is highly recommended. The period of training may be six months to a year. Training might also involve an internship with a related company. Salary: \$40,000–\$60,000.

Color specialist

Color specialists understand color theory as it relates to the printing process. A color specialist makes critical color judgments and fine distinctions among hues that enable impres-

Color specialist	Computer animator	Marketing specialist	Photographer	Educator
Computer technology	Design	Marketing	Digital imaging	Teaching methods
Color theory	Fine art	Management	Color theory	Curriculum development
Color management	Computer graphics	Accounting	Videography	Foundations of education
Graphic design	Videography	Advertising	Art and design	Laboratory management
Art	Commercial art	Public Relations	Computer solids modeling	Student teaching
Additional training or internship	Additional training or internship	Additional training or internship	Additional training or internship	Additional training or internship
Master's degree in graphic communication	Specialty school for animation	Internship with industries	Master's degree in graphics	State licensure requirement

Table 2: Courses that support given fields within graphic communication

sions to look like they were intended. Salary: \$40,000–\$60,000.

Careers in governmental agencies

Local, state, and federal agencies offer various career opportunities that require the creation and storage of graphic information. Some examples include in-house government printing and media services. Courses should be selected in consultation with the advisor. Salary \$30,000–\$50,000.

Educator

Educators are needed for graphic communication programs. Opportunities are available in the public school system, community colleges, and universities as well as training and development departments in firms. In order to teach at the high school level, interested students should enroll in a teacher education program and obtain a teaching license. Salary: \$21, 000–\$50,000.

Resources

There are many national resources that are available to assist in identifying career opportunities. See Table 3 at the end of this article.

Caution

The career fields shown in

Table 2 do not comprise an exhaustive list of fields in which printing and publishing graduates can work. However, the list does give students ideas from which to select a specific field of interest. Further, it emphasizes the importance of specifically preparing oneself for a particular graphic-related field. A degree in general printing and publishing provides good preparation for numerous areas of work. However, a general degree is not appropriate for some specific career paths. Students should not be misled, or allowed to mislead themselves, concerning what opportunities await them after graduation. Faculty advisors must clearly advise their students about the available career options. For example, a particular career path might require a student to opt for a double major. The student and advisor should carefully consider whether or not the second major will assist in meeting the student's career goals, and whether the student will have the time and resources necessary to complete the additional tasks.

A general education may be appropriate in some cases

There are exceptions to pursuing a specialized degree. It is not uncommon for individuals to have completed an associate degree program in graphic communication (printing and publishing) and enter the workforce. After a number of years, they

realize that additional education or training is necessary in order to advance. The bachelor degree could be an appropriate means for them to acquire the needed qualifications for career advancement. Another example might be that the student takes a part time job and later is offered a permanent position that is contingent upon the completion of a degree program. The permanent position may not deal directly with his or her chosen field of study. Examples of such permanent positions might include installing computer equipment, engineering support, or industrial sales.

Conclusion

Changes are inevitable in technological fields. Because of technological changes, employees will be given tasks for which they are not trained. Therefore, students should be prepared and understand that change necessitates that they always strive to increase and improve their knowledge.

Students should also understand that the best way to avoid uncertainty at graduation is to explore and/or specialize in an area of concentration soon after entering the university. Table 3 provides resources for career opportunities in printing and publishing.

American Forest & Paper Association
 American Institute of Graphic Arts
 Association for Graphic Arts Training
 Binding Industries of American Book Manufacturer
 Institute
 Digital Distribution of Advertising for Publication
 Digital Printing & Imaging Association
 Education Council of the Graphic Arts Industry
 Flexographic Technical Association
 Foil Stamping & Embossing Association
 Graphic Artists Guild National
 Graphic Arts Education & Research Foundation
 Graphic Arts Professionals
 Graphic Arts Sales Foundation
 Graphic Arts Show Company
 Graphic Arts Technical Foundation
 Gravure Association of America
 International Publishing Management Association
 IBFI International Association for Document &
 Information Management Solutions
 International Association of Printing House Craftsmen
 International Digital Imaging Association
 International Graphic Arts Education Association, Inc.
 International Prepress Association

National Association of Desktop Publishers
 National Association of Litho Clubs
 National Association of Printers & Lithographers
 National Association of Printing Ink Manufacturers
 National Association of Quick Printers
 National Council for Skill Standards in Graphic
 Communications
 National Scholarship Trust Fund
 National Computer Graphics Association
 Newspaper Association of America
 North American Graphic Arts Supplier Association
 NPES The Association for Suppliers of Printing &
 Publishing Technologies
 Optical Publishing Association
 Printing Industries of America
 Research & Engineering Council of the Graphic Arts
 Industry
 Screenprinting & Graphic Imaging Association International
 Society for Service Professionals in Printing
 Tag & Label Manufacturers Institute Inc.
 Technical Association of the Pulp & Paper Industry
 Technical Association of the Graphic Arts
 Waterless Printing Association
 Xplor International: The Electronics Document Systems
 Association

(from Education Council of the Graphic Arts Industry, Inc,
 1997; Flecker, S. A., & Groff, P. J., 1998)

Table 3: National resources for careers in graphic communication

References

Education Council of the Graphic Arts Industry, Inc (1997). *Discover print in the world of graphic communications* [compact disc]. Reston, VA: author

Flecker, S. A., & Groff, P. J. (1998). *Careers in graphic communication*. Sewickley, PA: Graphic Arts Technical Foundation Press.

National Scholarship Trust Fund. (1997). *Careers in graphic communications: A counselor's guide*. Sewickley, PA: Graphic Arts Technical Foundation Press.

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FileMaker Pro and the world wide web: Tools for estimating

by Dr. Thomas Bates and Dr. Mark Snyder

The process of estimating costs for printing production has evolved from being a manual process to one that is totally computerized. Today, instructors who would like to make a computerized estimating system available to their students have a number of avenues that they might follow. In this article, the authors will describe how Filemaker Pro can be interfaced with a browser to create an estimating system that can be accessed through the world wide web. With such a system, a user could enter certain job parameters then receive the estimated cost and the number of hours required to complete certain tasks. The authors focus on determining prepress costs since this area is a major cost area for students of printing and graphic design.

This article is not designed to be a step-by step guide on how such an estimating system would be created. Instead, it has been written as a description of the general procedures necessary in order to complete such a project.

Options

A number of options exist for instructors who want to teach estimating using computers. First, proprietary estimating systems are available, but they could run into the thousands of dollars to purchase. If more than one computer is required to access the system, the cost might be even higher. While proprietary systems may be cost prohibitive, and may not exactly match one's needs, they do have the advantage of being the type of estimating system that a student would be likely to use in industry.

Electronic spreadsheets are a great resource for creating an electronic estimating system. Instructors have already employed spreadsheets to create in-house estimating systems. Spreadsheets have an advantage over programming in that they are relatively easy to use and do not require extensive time to create. The large physical size of spreadsheets could be considered a disadvantage since they may be cumbersome with which to work. Each computer must be equipped with the spreadsheet program and the student must know how to use it.

Another approach would be to create a computerized estimating system using a programming language such as Visual Basic. There may even be some students majoring in computer science at your school who would be willing to work on such a project on an independent study.

Yet another choice would be to create an estimating program that could be accessed and used through the use of a web browser. Using the web for this purpose would be ideal since most students are provided access to the Internet, browsers are free, and there would be no additional charge for the classroom use of such a system once it was in place. Alternatively, a programming language could be used to engage a database program that would interface with a browser—anyone using a web page that allows on-line shopping is doing

just that. (Electronic shopping is a good example of web pages that provide for information entry and return a result based on the entry.) Although several databases exist that are capable of interfacing a database and a web page, the most practical one for instructors to use is Filemaker Pro. Filemaker Pro is available for both the Macintosh and Windows platforms.

The advantages of Filemaker Pro

Filemaker Pro is a cross-platform environment, while most other popular database programs are specific to either Windows or the Macintosh. Filemaker Pro is relatively easy to learn and it has a built-in web server that makes it simple to place web pages on the Internet. Creating a web estimating system requires more than HTML programming. So, another advantage of Filemaker Pro is that it comes with its own programming language that allows the user to interface a database with a web page. This programming language, called “Claris Dynamic Markup Language” (CDML), is not difficult to learn and Filemaker Pro provides a number of templates to assist in the learning process. Claris’ web-authoring tool, Homepage, has tools designed to allow the user to create web pages that use Filemaker Pro databases. Academic pricing is approximately \$119 for File-

maker Pro and \$49 for Homepage.

Creating a web-based estimating system

There are three major steps in creating an estimating system using Filemaker Pro and a web page. First, you must create the Filemaker Pro file that will be used to store your job information and process it. The second step is to create the web page that will allow the user to submit the information necessary for the estimate to be processed by the database file. The final step is to place the web page on an Internet server. In the following paragraphs, a general explanation of each step will be provided.

Creating the Filemaker Pro file

To ensure success, one must decide the parameters to be used in estimating. For the purposes of this article, an estimating procedure for electronic prepress functions was used as a guide. The guide, a “schedule for cost estimating desktop publishing and electronic prepress production” on page 410 of *Printing Estimating (4th edition)* by Philip Ruggles, provides production times for each prepress function. The creator of the estimating system must decide whether to use these predetermined times or to allow users to input their own. Users must also decide if Ruggles’ prepress cost production



Figure 1: Defining fields

areas meet their needs or whether they need to create their own. Once this is decided, the next step is to create the database file.

To create the database file there are five major steps must be completed. First, determine the type of field needed for each calculation or data entry. This is illustrated in Figure 1.

Once field type is decided, the creator must establish the necessary formulas for the calculation fields that require processing by Filemaker Pro. Figure 2 illustrates a field that has formulas necessary to calculate a particular cost or production time.

Once all of the calculations have been entered, the third step



Figure 2: Entering formulas

is to create the layout for the database file. The layout is what is seen by the individual creating the estimating file, not the web user. Laying the fields out in a logical manner can be helpful when the web pages are being created. Fourth, the file must be made sharable over the Internet. This is simply a matter of making a selection within Filemaker Pro—an issue that will be discussed later. Finally, the web pages must be created.

Creating the estimating web pages

One of the reasons for using Filemaker Pro as the basis for this estimating system is Filemaker Pro's easily-learned CDML language that permits web-pages to interact with a database. CDML commands are used to access the database. The basic procedure is to create two web

pages: the first is a form which is used to submit the data to Filemaker Pro, and the second is a return form that dynamically creates a page with the answers. See Figure 3 for the submission form and Figure 4 for the return form. To create the web pages, Claris HomePage Version 3 was used. HomePage provides good integration with Filemaker Pro (making the coding less difficult), the program is inexpensive, and the program will run on either PC or Macintosh platforms.

Figures 5 and 6 provide a quick illustration of some of the coding necessary for the files. Figure 5 illustrates the coding necessary to create the web page for the form, and Figure 6 shows the codes necessary to create a reply page (a page returned to the user of the estimating program).

In Figure 6, there are familiar

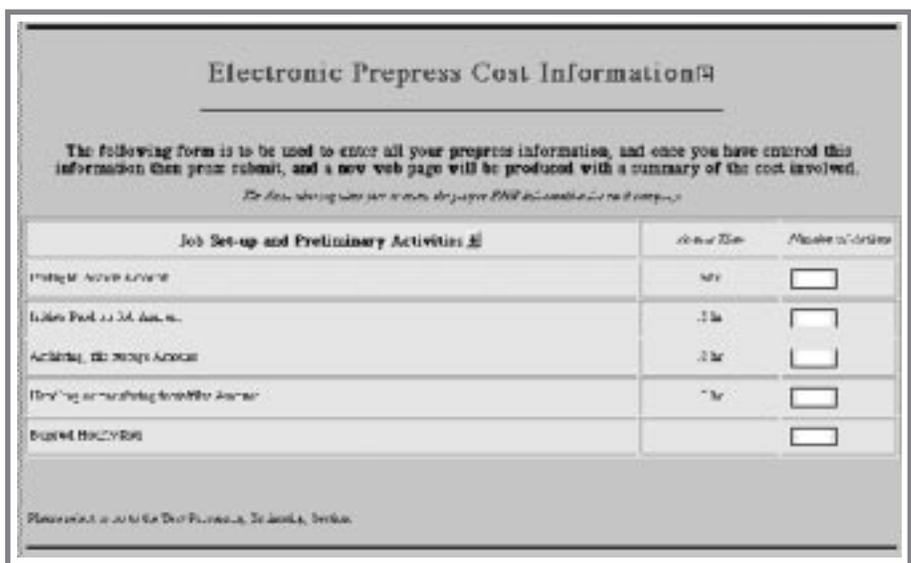


Figure 3: Submission form

Job Setup and Preliminary Times (hours)	Amount of Time
Total Time of Postflight	<input type="text" value="FMP-Field"/>
Total time of Inflight Production	<input type="text" value="FMP-Field"/>
Total time of Archiving	<input type="text" value="FMP-Field"/>
Total Time of handling the transfer	<input type="text" value="FMP-Field"/>

Figure 4: Return form

HTML codes as well as words such as “name=lay,” “value,” and “input type.” These are the CDML commands that are unique to Filemaker Pro and are not applicable to other databases. In Figure 6, there is a field named “FMP-FIELD: phonenumber.” This field, created in Filemaker Pro, will contain information that will be presented on the reply web page.

Once all coding is completed for the web pages, the next step is to place the pages on a web server. Remember that one of the advantages of Filemaker Pro is that it provides a built-in web server that makes it rather easy for the creator of the estimating system to make pages available over the web.

Setting up the web server

There are a number of approaches to setting up a web server so web pages from that server can be accessed over the Internet. There are two basic requirements. First, you must have a static connection to the Internet. A static connection means that there is always an Internet connection while the web server is running. To ensure

a static connection, the server must be connected to the Internet by way of a network (normally your school’s network), not by way of a modem. There is normally no need to log on unless your organization has its own login procedures for its network. A static connection makes the server available to anyone else on the Internet as long as a web server is running and the Internet address is known.

Setting up a web server on your computer is not a difficult

task so long as there is a static connection. There are a number of web servers available—some are free. A web server is part of Macintosh System 8.X. Another web server, MS Personal Web Server (a free download from Microsoft), is available for both the Macintosh and Windows platforms. The installation procedure for each of these servers is covered in the server documentation and requires only a few minutes. Once the server has been set up and configured, web page

```
<HTML>
<!--This file created 3/25/99 1:10 PM by Claris Home Page version 3.0-->
<HEAD>
  <TITLE>Customer input information</TITLE>
  <META NAME=GENERATOR CONTENT="Claris Home Page 3.0">
  <X-CLARIS-WINDOW TOP=66 BOTTOM=480 LEFT=8 RIGHT=538>
  <X-CLARIS-TAGVIEW MODE=minimal>
</HEAD>
<BODY BGCOLOR="#CCCC99">
<CENTER>&nbsp;&nbsp;&nbsp;</CENTER>

<P><FORM ACTION="FMPPro" METHOD="POST">
  <P><INPUT TYPE="hidden" NAME="-DB" VALUE="prepresscost1.fp3">&nbsp;&nbsp;&nbsp;<INPU
  TYPE="hidden" NAME="-Lay" VALUE="layout #1">&nbsp;&nbsp;&nbsp;<INPUT TYPE="hidden"
  NAME="-Format" VALUE="elecprereply1.htm"></P>

  <CENTER><FONT SIZE="+3" COLOR="#000099"><B>Customer Estimating
  Information Form<A NAME=begin></A></B></FONT>

  <P><FONT SIZE="+1" COLOR="#000099"><B>Please enter the information
  requested below</B></FONT></P></CENTER>
```

Figure 5: Codes to create a form

```
</FONT></CENTER>

<P><FONT SIZE="+1">Customer Name</FONT><FONT SIZE="+2">
</FONT><FONT COLOR="#0000CC">[FMP-FIELD: custname]</FONT></P>

<P><FONT SIZE="+1">Address</FONT><FONT COLOR="#0000CC">[FMP-FIELD:
address]</FONT>
<FONT SIZE="+1">City
</FONT><FONT COLOR="#0000CC">[FMP-FIELD: city]</FONT>
<FONT SIZE="+1">State</FONT>
<FONT COLOR="#0000CC">[FMP-FIELD: state]</FONT>
<FONT SIZE="+1">Zip</FONT>
<FONT COLOR="#0000CC">[FMP-FIELD: zip]</FONT></P>

<P><FONT SIZE="+1">Area
code</FONT><FONT COLOR="#0000CC">[FMP-FIELD: areacode]</FONT>
<FONT SIZE="+1">Phone
Number</FONT><FONT COLOR="#0000CC">[FMP-FIELD: phonenumber]</FONT></P>

<P><FONT SIZE="+1">Contact Person
</FONT><FONT COLOR="#0000CC">[FMP-FIELD: contact]</FONT></P>

<P><FONT SIZE="+1">Job Description
</FONT><FONT COLOR="#0000CC">[FMP-FIELD: descrip]</FONT></P>
```

Figure 6: Codes to create a reply page



Figure 7: File sharing



Figure 8: Configuration

delivery can begin.

Each computer on the Internet has a unique address called the IP address. In order for web users to access web pages, the server's address must be known. To determine your server's IP address, review the server's network software or ask your computer department. This address is normally a twelve-digit number, such as 204.171.105.152.

The project illustrated in this article utilized a free Filemaker Pro web server. The Filemaker Pro server is uniquely designed to serve web pages from a database. Setting up this server involves file sharing and configuration activities. File sharing is illustrated in Figure 7 and Figure 8 illustrates configuration. Network sharing must be set to

“multi-user” and companion sharing must be turned on. The configuration of remote administration, security, and ports is shown in Figure 8. Pay close attention to the port. When there is already a web server running on a computer, such as in the situation shown in Figure 8, an alternate one must be designated for Filemaker Pro. The use of an alternate web server allows the user to access web pages through the proper server, which, in this case, is the Filemaker Pro server.

To access web pages using the Filemaker Pro server, the user would type an address such as `http://204.171.105.152:591/estimating1/input1b.htm`.

With regard to the address, three items need to be explained. First, you may ask why a number (the server's IP address) is entered after the “http” rather than a sequence of words. Translating an IP address to a domain name requires your school's network administrator to assign your server a name in its main Internet computer's host file. In the case described in this article, the school had not developed a system for translating IP addresses to domain names. If the school had resolved this issue, then the address might look something like a more familiar address: `http://www.esteeming.laroche.edu/esteeming1/input1b.htm`.

The second part of the address that may appear unusual is the

“:591.” This numeral represents the port in the server from which the Filemaker Pro web server functions. It directs the user's inquiry to the proper web server, and then to the proper web page.

“Estimating” is the folder or directory where your web pages are stored. For a user to access the web page to create an estimate, the user would type an address such as the following in the browser: `http://204.171.105.152:591/esteeming1/input1b.htm`, and then proceed as they would with any other web page that has a form.

Future considerations

Once a database that allows students to access an estimating program is completed, there are still a number of other features that could be added. Some features might include: allowing the user to search the database for a particular estimate that was previously completed; find jobs which have been estimated for a particular customer; obtain a list of jobs; or compile a list of customers. All these procedures are possible because Filemaker Pro's CDML language allows searches to be made of existing databases. Search results can then be displayed on a web page. Each time an estimate is calculated, a new record is created. Thus, previous jobs can be reviewed and printed from a browser.

Summary

Graphic Communications instructors may not include estimation as an integrated part of a course because they leave no convenient way to complete estimates. By placing the estimating program on the Web, the instructor and students are able to submit jobs specifications rather easily on a web page and receive feedback instantly.

The cost of creating such web pages is inexpensive, in terms of time and money, when compared to other available means. A

group of instructors, working together by way of the Internet, could rather quickly establish web-based estimating systems that could be available to any graphic communication students connected to the Internet.

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Essential knowledge and skills to improve team effectiveness

by Dr. Yung-Cheng Hsieh

The Toyota Production System has become the world model of quality and efficiency. Its success has nothing to do with Japanese wage rates, but rather with the advantages of a different system—an effective team approach. Miller (1991) indicated that Eiji Toyoda and Taiichi Ohno, the president and production chief, respectively, of Toyota in 1950, found that the employees could track down and eliminate causes of problems if a flexible and powerful team system was employed. Toyoda and Ohno worked with teams to eliminate waste in time, motion, and materials. The best results came when teams took responsibility for improving their own work process. The superiority of this new system of work is being discovered in many countries, in virtually every industry.

Working in teams allows employees to take a high level of responsibility for their own work and feel the dignity caused by ownership of their own processes. Teams at Federal Express, Metropolitan Life, Xerox, Milliken, Texaco, Kodak, and hundreds of other companies, now take responsibility for managing themselves. The teams respond quickly to their customers, study and improve their work process, are highly productive, and provide superior-quality products (Miller, 1991).

Increases in quality and productivity most often result from effective teams—groups of people who pool their skills, talents, and knowledge. Effective teams require their members to have new skills and knowledge. With proper training, teams can often tackle complex and chronic problems and come up with effective, permanent solutions. The purpose of this paper is to assess existing training materials focusing on improving team effectiveness and identify the essential skills and knowledge that should be encompassed in

the curriculum to improve team effectiveness.

Essential skills and knowledge

As organizations develop and design their training curriculum to improve team effectiveness, they should make sure that certain basic ingredients are included. An examination of existing training programs that focus on improving team effectiveness found three common elements: communications skills, thinking skills, and knowledge of how to work together.

Communications skills

According to the Workplace Basics report (Carenevale, Gainer, & Meltzer, 1988), recent studies have indicated that only job knowledge ranks above communications skills as a factor for workplace success. Thus, success on the job is linked to good communications skills. Communications skills are particularly important for team members because members communicate with each other about procedures and problems and they relay information to and from customers.

Effective listening and speaking

Listening skill curricula should simulate actual workplace experiences and assist trainees to understand how listening style affects the transmission and

receipt of information. Instruction should focus on five listening skills that are critical for team and workplace success: listening for content; listening to conversations; listening for long-term contexts; listening for emotional meaning; and listening to follow directions (Carenevale, Gainer, & Meltzer, 1988).

Instruction in effective speaking skills provides workers with an understanding of the importance of voice inflection and body language when communicating. Team training in oral communication should also simulate actual workplace circumstances. Employees should learn how to recognize their dominant style of communication and how that style is manifested, understand and value communication styles that are different than their own, and adjust their dominant style to someone whose style differs (Carenevale, Gainer, & Meltzer, 1988).

Presentation skills

Today's audiences grew up with television. They are accustomed to learning through programs that are fast-paced, with sound-bite-sized "chunks" of information and lots of dazzling visuals (Zenker, 1992). Speakers who cannot live up to these expectations will soon find themselves facing rooms full of bored faces or empty chairs. Effective speakers know their audiences and understand that

contemporary audiences expect professionalism, polish, and high-quality visuals. Effective speakers know how to reach audiences and how to keep them interested throughout a presentation.

Interpersonal skills

Interpersonal skills are the key to maximize the effectiveness of a team. Van Ast (1990) indicated the purpose of interpersonal skill training is to encourage trainees to learn how to:

1. work effectively under different kinds of supervision.
2. work without the need for close supervision.
3. be on time for activities and appointments.
4. work effectively when time and pressure are critical factors.
5. see things from someone else's viewpoint.
6. engage appropriately in social interactions.
7. be responsible for the effects of one's own judgments and actions.
8. plan, conduct, and complete self-directed activities.
9. speak with others in a relaxed, self-confident manner.
10. initiate task-focused conversations with others.

Thinking skills

Thinking skills play a vital role in the processes of decision making and problem solving. Think-

ing skills training seeks to expand the thinking processes of trainees. For example, it can help trainees escape from logical and sequential thought patterns.

Decision making

The role of the effective manager has evolved from one who is all-knowing, tough, and single-minded, to one who can motivate and challenge teams to be creative and competent. An effective manager can also participate in team decision making processes. Thus, the development of the team's decision-making skills becomes more and more important. To maximize the productivity of a team, an effective decision-making process must be taught through the training program.

Lippitt (1978) offers some valuable advice on the subject of team decision making. He outlined eight important criteria for an effective decision-making process:

1. a clear definition of the problem,
2. a clear understanding of who has the responsibility for the decision,
3. effective communication for idea production,
4. appropriate size of group for decision making,
5. means for effective testing of different alternatives,
6. method for building commitment to the decision,
7. honest commitment of the leader to the team decision-

making process, and

8. an agreement on the procedures and methods for decision making prior to deliberation on the issue.

Problem solving

Teams solve problems better when sound group processes are used. Effective group processes help members to find the best possible solution to a problem rather than impose their individual views. Open communication is expected, and team members are encouraged to challenge ideas to test their usefulness to solve the problem. A successful solution from a team is often far more effective than single solutions offered by individuals (Maddux, 1992).

Glassman (1991) suggested a six-step model for creatively problem-solving process.

1. Define the problem and list many problem statements.
2. Identify criteria to select the final problem statement.
3. Select reasonable problem statements.
4. List many ideas.
5. Identify criteria to select ideas.
6. Combine ideas into creative trigger-proposals and workable solutions.

Knowledge of how to work together

The objective of teaching employees how to work together

is to help team members recognize the differences between individuals and teams and to make any required behavior or attitude changes. Working together effectively produces high morale and allows the team to fully utilize all the abilities, knowledge, skills, and experience of team members.

Conflict resolution

Conflict is always present because of individual differences in needs and values; differences in perceiving motives, words, actions and situations; differing expectations of outcomes—favorable versus unfavorable; and unwillingness to work through issues, collaborate, or compromise (Maddux, 1992). Conflict is inevitable and is an integral part of the process of change. It becomes unhealthy when it is avoided and is healthy when it is dealt with constructively. In other words, constructive and healthy conflict has a problem-solving base. Woodcock (1989) suggested six means to resolve unhealthy conflict:

1. examining what is causing trouble between team members;
2. bringing the parties together to discuss the issues involved and to analyze their constituents;
3. clarifying expectations and roles;
4. learning how to utilize constructive feedback and value openness;

5. learning how and when third parties can be helpful; and
6. reaching agreements about future action.

Productive meetings

Though individual team members carry out assignments between team meetings, much of the team's work gets done when all team members are together during meetings. Many people dislike meetings, but meetings do not have to be distasteful. Like other processes, they can be studied and constantly improved. Productive meetings enhance the probability of a successful project (Scholtes, Joiner, Finn, Hacquebord, Little, Reynard, Streibel, Weiss, 1994). Productive meetings depend upon two components: meaningful meeting rules and meeting records.

Meeting rules

Scholtes et al. (1994) suggested six basic meeting rules:

1. use agendas,
2. have a facilitator,
3. take minutes,
4. draft next agenda,
5. evaluate the meeting, and
6. adhere to a "100-mile rule."

Agendas should include information about the agenda topic, the presenters, a time guideline, and the meeting type (discussion, decision, or just an announcement). Each meeting should have a facilitator, who is

responsible for keeping the meeting focused and moving, and a recorder, who records key subjects and main points raised and decisions made. A team may rotate the facilitator and recorder responsibilities among its members. At the end of each session, review and evaluate the meeting and draft an agenda for the next meeting. The "100-mile rule" is to encourage everyone to give his or her full attention to the meeting. It will need to be communicated repeatedly to those who keep taking phone messages or who would interrupt the team's work for other reasons (Scholtes et al., 1994). These meeting rules can help improve the problem-solving and decision-making process, and reduce conflict during the meeting.

Meeting records

A record about decisions and problems at each meeting prevents unnecessary rehashing of issues and conflict. Scholtes et al. (1994) indicated two major components that must be included in the records.

1. Action list: a record of the "to do's" decided during the meeting, noting who has agreed to do what by when.
2. Future list: a record of items for action or discussion that the team agrees are worthwhile, but should be undertaken later.

Applications

The information provided by this article can be used in a number of ways, and different program designs can be derived from the material covered. A few possibilities are presented below to show how the material can be prepared for different purposes. However the reader is strongly advised to create his or her own designs.

1. Teamwork workshops: The information in this article is ideal for pre-assigned reading materials prior to a workshop or seminar. It can be also effective when a trainer distributes it at the beginning of a session and leads participants through the contents. A medium-length event can be designed to enable people to familiarize themselves with essential knowledge and skills as a prelude to understanding team-building activities in their own teams or organizations.
2. In-company training courses: The information provided here can meet the needs of busy managers. Based on the essential content found in this article, an in-company training course can be prepared by people who have extensive experience in the design, development, and teaching of in-company training courses.

3. Remote location training: Copies of the information provided here can be made available to those who are not able to attend home-office teamwork training sessions.
4. Introduction to teamwork seminars: An introduction to team development can be designed for people who do not regularly work in teams and wish to be introduced to its potential. A one-day event might be also designed for a new team that it can work seriously on the fundamental issues that will improve its effectiveness and productivity.

Summary

This paper proposes three groups of essential skills and knowledge to improve team effectiveness that should be encompassed in the curriculum of team training programs:

1. communication skills,
2. thinking skills, and
3. knowledge of how to work together.

Based on these three major areas, a model of team effectiveness is shown in Figure 1.

The common goal(s) of a team cannot be achieved unless a good relationship and trust are built among its members. This requires that all team members possess effective listening and speaking and interpersonal skills. These communication skills can



Figure 1: The model of team effectiveness

be taught and learned. Team members cannot work closely together unless the roles that they play in the team are clear. Effective meeting skills must be learned so that meetings are productive and reasonably free from conflict. Expectedly, the skills and knowledge of how to work together will change individuals' behaviors on the job. These changes of attitude and behavior can help teams to increase their process capability, and, therefore, boost return on investment (ROI).

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Photography for reproduction

by Dr. Chris Lantz

Many publishers have routinely relied on digital imaging for low resolution applications in newspaper production and desktop publishing for just over a decade. Cameras that capture just beyond television resolution images (640×480 pixels) are adequate for some of these applications and typically cost \$300–\$1,000 today. Low-resolution digital cameras are well suited to web sites, computer presentations, and output to laser printers because their resolution capacity matches the typical output resolution of low-cost monitors and printers. Higher resolution megapixel cameras have recently been introduced at slightly under \$1,000 for the first time. These new low-cost cameras complement the increasingly common 1152×780 computer display resolution and desktop printer resolutions above 600 dots per inch (dpi). The future widespread adoption of the Federal Communications Commission approved HDTV (High Definition TeleVision) standard will likely spark a new round of low cost digital cameras to fill an even higher resolution standard in the near future. At the upper end of the digital camera market, commercial publishers have used high resolution digital cameras for catalogs and periodicals which depend on the rapid production of hundreds of images per issue. Currently, there are high resolution cameras in the \$10,000–\$20,000 price range that can approximate the resolution of ISO 400 speed 35mm transparency film. There are also cameras in the higher \$25,000–\$50,000 price range that can approach the resolution of conventional films such as ISO 25 speed 35mm transparency film. Some imaging technologies can now exceed the resolution of large format 4×5 or 8×10 inch film, but these currently are only cost effective for applications such as remote imaging via satellites.

Even though the quality of images that can be produced by digital cameras has increased dramatically in the past few years, they may not be appropriate for many uses. In this paper, the author compares the characteristics of film-based cameras to the characteristics of digital cameras and makes recommendations regarding the use of each type of camera in today's market.

Camera controls: digital versus analog

A disadvantage to many of the low- to mid-priced digital cameras on the market is they rarely have the manual exposure and focusing controls on which professional photographers depend. Some high-end digital cameras in the \$8,000-\$25,000 price range are actually film-based cameras that are converted to digital-based cameras by replacing the film back with a digital sensor back. These converted cameras are equipped with the manual controls of the standard 35mm camera from which they were created.

In the \$500-\$3,000 price range, digital cameras do not have the depth of field control afforded by f-stops, nor the motion-stopping control provided by a manual shutter speed. These are major limitations that prevent many professional photographers from switching to the digital format. Control over depth-of-field and motion stop-

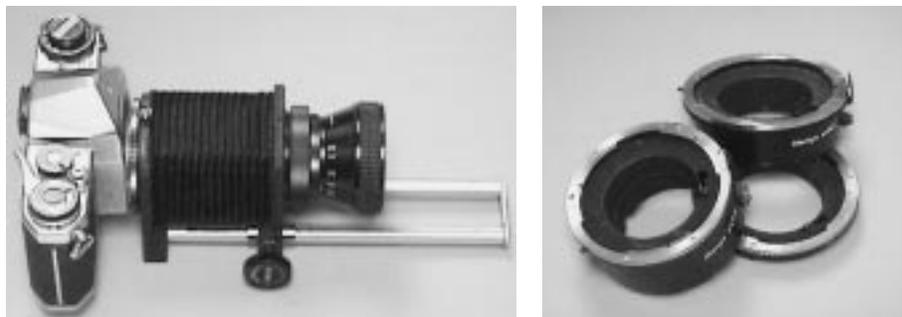


Figure 1: Bellows (left) and extension tubes (right) provide cameras an ability to image objects larger than life size on film. The greater the distance between lens and camera the closer focusing distances are possible.

ping capability are essential creative tools of the professional photographer.

Another drawback of the low-cost digital cameras is that they do not have a removable lens mount. Hundreds of conventional 35mm SLR camera lenses and accessories are available. Without access to special lenses, photographers cannot use low-cost cameras to control the angle of view and perspective of objects in the scene. In addition, close-up or macro photography is not an option when using many low-cost cameras, because special equipment, such as extension tubes and bellows, is not available (Figure 1).

Other big disadvantages of the lenses on low-cost digital cameras are their relatively low quality and less-than-optimal light gathering ability. High-speed lenses transmit more light when needed in low lighting situations. Digital camera lenses are often quite slow, so harsh flash lighting is necessary. When compared to

natural light, electronic flash lighting is unnatural by virtue of its angle and the high contrast of the shadows it casts. There are some techniques that can be used to soften flash lighting, such as bouncing it off a white card, but the small built-in flash lamps available on digital cameras lack both the power and angle adjustments to make such techniques possible (Figure 2).

Most of the lowest-cost digital cameras have fixed-focus or focus-free lenses. Fixed-focus means that the lens was fixed at one focus point at the factory and that any subject closer or further away from this point will be out of focus (Figure 3). The focus point is in the middle of the lens focus range. This provides a reasonable chance of getting a sharp picture, but the drawbacks of fixed focus are very apparent with close up photography.

Better digital cameras have true auto focus mechanisms which ensure sharp focus on subjects at various distances from

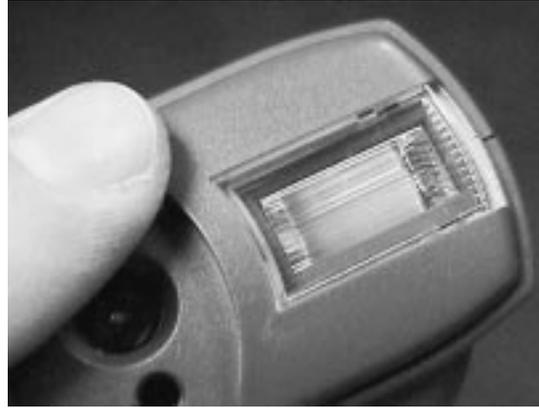


Figure 2: The flash built into digital cameras are not adequate in power nor have the angle adjustments to allow softer more natural reflected light as is provided in the bounce flash setup on the right.

the camera, so long as the subject is in the center of the viewfinder. Autofocus systems have a sensor that measures the distance to the subject and then changes the focus of the lens elements to compensate for different distances. Although this is much better than fixed focus, it still causes problems if the photographer wishes to place the subject of the photograph off-center. One approach to solve this problem is to use multiple focus sensors across the field of view and not just in the center. This improved focus system is available in conventional cameras but not for low-cost digital cameras.

Low-cost digital cameras often lack light metering features such as multi-cell metering and backlight control. In addition to calculating the focus from the center of the viewfinder, many cameras measure the amount of light in the scene from the center only. This can cause problems if

the subject is dimmer or brighter than the background or if the subject is not centered in the viewfinder. Multi-cell metering collects light readings from various positions in the viewfinder and averages the readings. Multi-cell metering compensates for back-lit scenes that would turn out as silhouettes without this feature.

Finally, most entry-level cameras lack a manual exposure over-

ride. Manual exposure allows photographers to produce a dark or light picture on purpose or as a special effect. Even if the photographer is shooting a dark or light subject, the exposure system in an automatic camera is programmed to produce an 18% gray average density. If manual exposure controls were provided, the photographer could overexpose to compensate for a light subject or underexpose for a dark subject.

Despite the disadvantages of low-cost cameras, they still have many important advantages. A 640×480 image can be acceptable, even in high-resolution magazine publishing, if it is used at a fraction of its original size. Many lower-cost cameras are just starting to incorporate exposure value (EV) adjustments, which photographers can use to adjust to prevailing lighting conditions using a built-in LCD preview screen (Figure 4). As digital photography rapidly becomes more

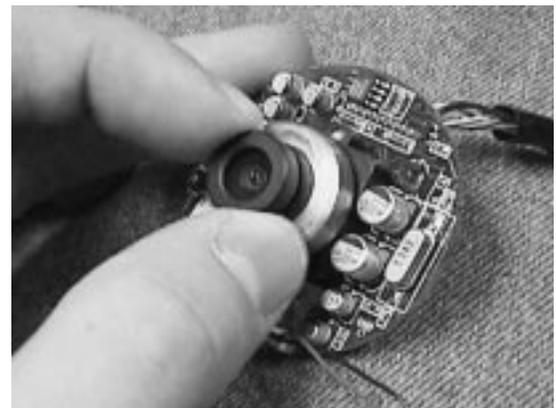
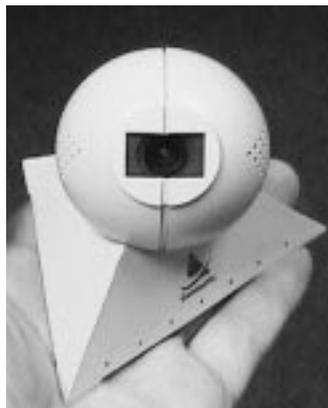


Figure 3: The Quickcam is an example of a fixed focus digital camera (left). It is possible to change the fixed focus point but the camera needs to be disassembled in order to accomplish this, as is demonstrated on the right.

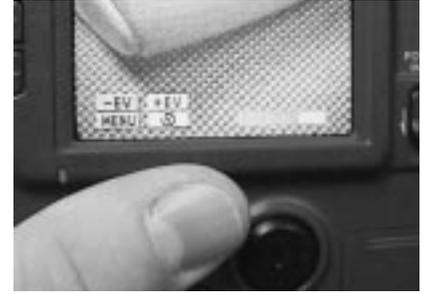


Figure 4: This digital camera has the ability to capture images on standard floppy disks (left). It also has a three inch LCD viewing screen. This screen is used as a viewfinder, to preview images, and also make exposure adjustments with a built-in EV exposure value control (right).

mainstream, many of the features that are presently lacking in low-cost cameras will be included. When this happens, many more applications will be opened up to digital imaging.

As recently as 1996, only a few low-cost digital cameras were available. By 1998, there were over 50 models. One new type of digital camera is the Digital Video Cassette (DVC) camera that can be used to capture both still pictures and video (Figure 5). DVC cameras have a new Firewire computer interface. Firewire allows the direct transfer of digital data from a DVC to a computer. In the past, when photos were needed from a video source, the computer required a specialized video capture board (Figure 6). DVC cameras allow the direct capture of individual video frames because data storage in the DVC and computer are both digital. No converting of analog to digital video is necessary.

Basic image structure: digital versus analog

In spite of these rapid developments, digital imaging technology has not overtaken traditional photography as the standard format for many commercial publishing applications. This is mainly due to the fact that conventional photographs are very high in resolution and low in cost. Kodachrome color slide film, invented in 1937, currently costs under \$10 per roll, and, when scanned on a high quality drum scanner, can exceed the resolution of \$25,000 digital imaging systems. An imaging system that costs \$25,000 today

will be much less expensive in the future. However, even the most optimistic do not predict that digital imaging systems will be able to financially compete with most film-based systems in the short term. Even if revolutionary imaging systems were developed in the short term, problems, such as projection and display of images, will still exist. Computer projection, LCD, and flat plasma panels are great recent strides that have been made in digital image display. However, these devices typically provide definition just slightly more than twice the resolution of the present-day National Television Standards Committee standard (NTSC). A



Figure 5: The digital video cassette (left) is a new video format that can interface directly with a computer with the firewire interface (right).



Figure 6: These are the video input/output ports of a video capture card on the back of a computer. A video capture or digitizing card takes input from a standard analog video source and converts it to digital data.

typical data projector in the \$5,000–\$10,000 price range can produce a maximum resolution of 832×624, and this is at least 100 times less resolution than

conventional large-format film. A typical 35mm slide projector costs from \$200–\$500 and is smaller, lighter, less fragile, higher in resolution, and more reliable than a data projector for presentation of static images. Film recorders can record computer images on 35mm slides, and many presenters prefer using a low cost slide projector to present these slides as compared to the inconvenience of setting up a laptop and portable data projector.

Another advantage of film versus digital is that images archived on film are far more permanent than those recorded on electronic media. The projected life of some prints and transparencies is well over 100 years.

In particular, black-and-white photos have very good archival characteristics because they are metallic silver; most deterioration of black-and-white plates is caused by tarnish and atmospheric conditions. Although some CD-ROM media could last just as long as black-and-white photos, it is unlikely that many CD-ROM drives will be around in 100 years. Film is still less expensive than magnetic or CD-ROM media to store high resolution images. For example, hospitals still store x-ray films because digital images cannot match the resolution of a large format x-ray without taking up an enormous amount of storage space. Many soft tissue details could be lost if x-ray images are scanned at a low-enough resolution for economical archival. Even those medical imaging processes that originate from digital data, such as CAT scans or NMR, are imaged on conventional photographic film, using a film recorder, for study and storage.

So, how can such an old chemical based imaging system such as photography, invented by a fortunate discovery in the mid 1800's and perfected in the early 1900's, beat out the current state-of-the-art digital imaging and projection systems in terms of resolution, price, and longevity? The main reason is the nature of the smallest picture element or pixel. In electronic images, these are manufactured in the form of

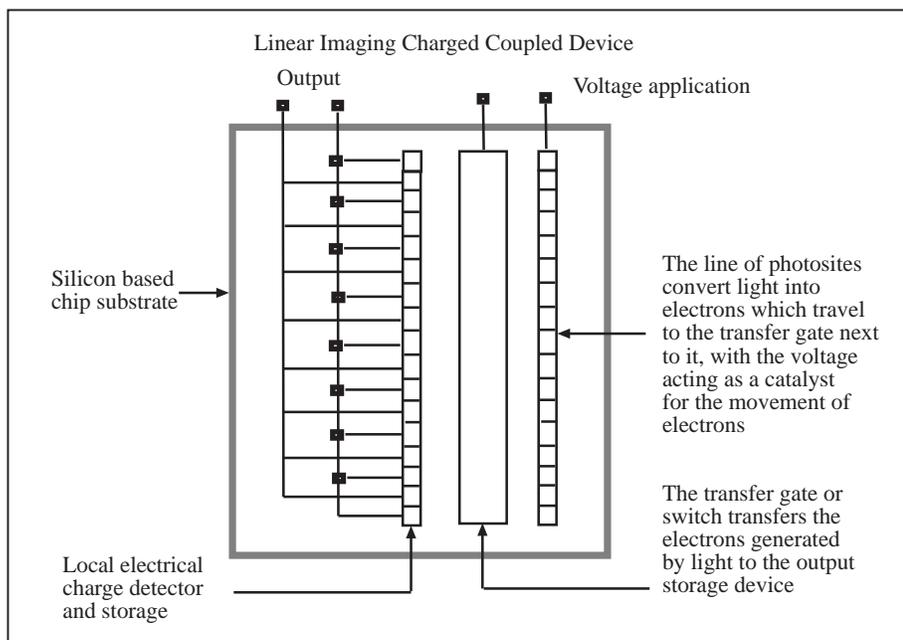


Figure 7: The basic structure and operation of a CCD or charged coupled device.

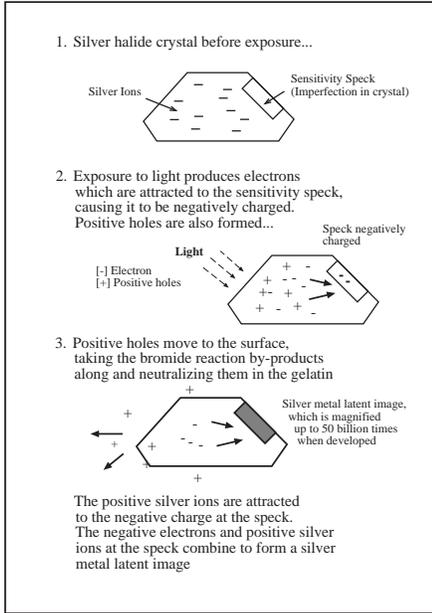


Figure 8: Latent image formation and development

a photosite on the surface of an imaging device, such as a charged coupled device (CCD) (Figure 7). The size of these photosites is limited to the capacity of the silicon wafer or chip substrate material on which they are manufactured. Currently, whole computers can be put on a portion of such a silicon wafer—these become a system's microprocessor. Unfortunately, current chip fabrication processes cannot place the required number of densely-packed photosites on a chip to match the resolution of conventional film. Film has a densely-packed structure of picture elements because these elements are not manufactured and are not directly limited to any physical manufacturing capability. Rather, film picture elements are created on an atomic level.

Photographic image formation

Light-sensitive photographic film is made from silver salt crystals, suspended in gelatin, that are coated onto a clear polyester film base. This coating is thinner than a human hair. Each of these silver salt crystals is sensitive to light and are created by the mixing of silver nitrate and a halide such as bromide. A latent image is defined by just a few atoms of silver formed by exposure to light in an individual silver salt crystal. Latent images are developed in a chemical developer, which amplifies the atomic silver millions of times, into a visible picture element (Figure 8). A photographic image is made permanent, or fixed, by removing those silver salts which have not been exposed to light and do not con-

tain a latent image. This leaves a permanent silver metal image.

The amplification of the atomic silver to a visible but extremely minute picture element in the developing process is comparable to converting the mass of a golf ball into the Empire State Building. Development is incredibly efficient and requires very little light to produce an image on film. Film's ability to magnify light in high-resolution distinguishes itself from high resolution digital imaging. Magnification of light is possible using digital imaging. However, this magnification currently leads to a comparatively large loss of resolution. More light is needed for higher resolution for both film- and digital-based imagery. An increase in light yields more resolution in film than it present-

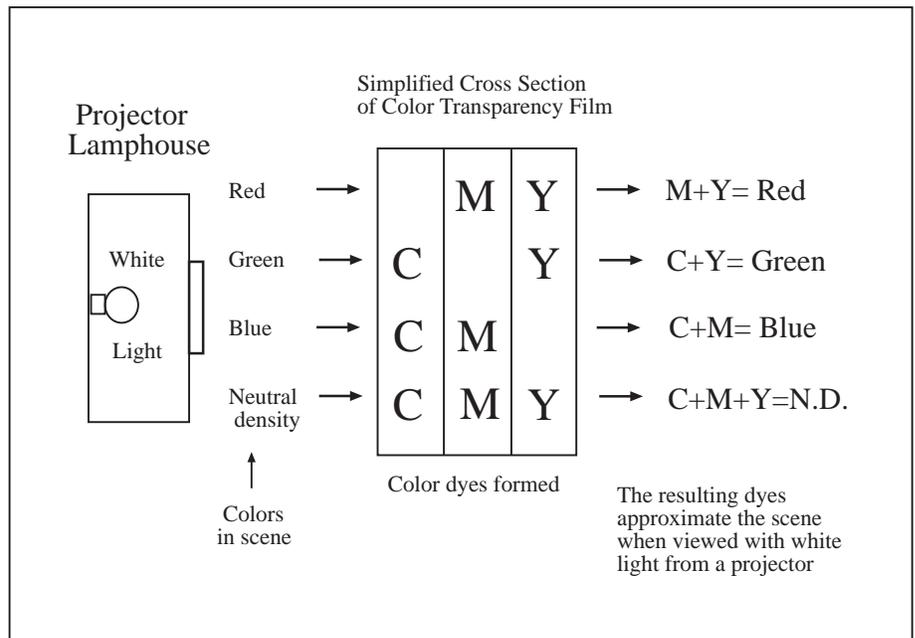


Figure 9: Color formation in photographic film

ly does in digital imaging. High-resolution film is less sensitive to light, and requires more exposure, because the light-sensitive crystals are smaller and have less surface area to collect light. More light is also needed for digital imaging so that all the photosites can be activated. When more photosites are activated, more picture elements are used to make up the image, and greater resolution is achieved. Current technology severely restricts how small and numerous these photosites can be when compared to high-resolution conventional film.

In color photography, the same light-sensitive silver halide principles are used to form a latent image, although the development of the visible silver image from the latent image is just a preliminary step. Color film contains silver salt layers that act as catalysts in the formation of cyan, magenta, and yellow (CMY) dyes in the final image. Bromide is released as a by-product when the silver is formed in these layers during development. This bromide by-product reacts with an oily substance, called a color coupler, in the film. There are couplers in the layers of the film that produce CMY images upon contact with the bromide. The silver formed in the production of the CMY dyes in color processing is bleached out in the later steps of development. Therefore, the final image contains only CMY dyes (Figure 9).

Early color photography used the additive red, green, and blue (RGB) photographic process similar to the RGB glowing phosphors on a TV. Since RGB pigments could not be created on a minute chemical level, they could not produce as much resolution and this approach was abandoned with the exception of Polaroid instant photography.

Relationship between photographer and printer

Film-based photography is capable of producing images with a greater dynamic range and higher resolution than digital cameras. The main problem is that the detail and tonal range of film-based photographs are greater than the capabilities of printing presses. Digital images have less dynamic range than film-based photographs, so they are closer to the range that the press can reproduce. Many film-based photographers use the full range of tones available in film and are not aware of the tonal limits of the printing process. In many cases, the printer is able to compress tones in originals at a point where they are not easily detected, such as in dark shadow areas.

Many factors of the printing process can be standardized, although conventional photographs are almost never the same and variations are hard to anticipate. Because photographs are often inconsistent, a scanner op-

erator must develop skills to interpret and correct for miscalculations and standard variations in originals. Standardization is likely to improve when more photographs are created digitally. Digital photographs are more consistent, so the quality control loop can be tightened between the photographer and the printer. Until this happens, inconsistency will prevail as a consequence of mixed imagery.

Many photographers are trained to produce display originals for gallery applications. Such originals usually utilize most, if not all, of the range of tones the imaging system can produce. It is a common practice in photography to make sample swatches of the highest and lowest densities the photographic material can produce and use these as aim points for placement of the highlight and shadow. This procedure ensures a wide dynamic range, which is appealing for display purposes, but is inappropriate for even the best printing conditions. Original prints made for display purposes can have a range higher than 100:1, while transparencies can range from 250:1–500:1 and above. In one example, the range from white paper to maximum ink density in one press impression can reach 20:1 and duotones on coated paper can reach 100:1. It is unfortunate that many photographers are not aware that tone reduction can reach up to 50%. Some photographers have

the impression that a printed facsimile is possible and information such as “match original” may be the only input given by the photographer. Faced with this type of unrealistic instruction for a long range original, it is easy to see why printers may be skeptical of the value of communication: “Photographers are becoming careless and submit photographs with inferior quality that cause many problems in reproduction,” or “it is realized that photographers will construe any effort to get them to reduce the lighting contrast of their originals as an attempt to stifle their creativity” (Bruno, 1989 p. 94).

The importance of graphic arts training for photographers depends upon the environment in which the photographer works. A freelance commercial photographer serves a variety of clients who may use different printing houses that produce at varying levels of quality. Even in situations where consistent corporate publication departments or art directors are involved, it would be desirable for the photographer to understand that consistency can greatly reduce work and aggravation for the printer. Experienced commercial photographers develop competencies that enable them to interpret which tones in a photograph are reproducible. Once the graphic arts is understood as a process of compromise, photographers can influence the reproduction of images by choosing tonal ranges that are reasonable.

Measured photography

Prepress scanning and image processing technology have made correcting original images far more flexible and rapid, but have not solved the basic problems of tonal incompatibility between photographs and printing processes. Standards, such as measured photography, have been proposed to assist photographers in conforming to reproduction parameters. Measured photography attempts to match the range of tones in original photographs to those that can be reproduced under local offset press conditions. Many digital photographers go a step further and are now in more direct control of reproduction because they submit images directly in the CMYK color space. Traditional photographers depend more heavily on the skill of others in the production team. For photographers who work directly with art directors, knowledge of tonal losses provides the ability to communicate which tones are most important to fit into the press window.

The implication of emphasizing the controls available to photographers is that quality control efforts can be focused on solving common problems in originals before they reach prepress. Eliminating or fixing a problem as early as possible in the reproduction chain costs much less than corrections made further down the reproduction chain. Measured photography is a method that photographers can

use to conform the scene brightness range of their subjects to average press conditions (Sinar, 1987). Measured photography can convert the density range of ink on paper to an f-stop range that can be used by the photographer in setting up lighting in the studio or fill-in lights outdoors. The f-stop range is set by measuring the ratio between the key and fill light with a light meter. The key light is the brightest and defines the direction of the shadow in the scene. The fill light is dimmer and determines how much detail will be present in the shadow.

For excessive scene contrast in outdoor situations, use of an auxiliary light source will increase detail in the shadow areas. Auxiliary light sources can include a fill flash, reflector

1. Daylight Scene	
F-stop Scale on Camera Lens	
2	2.8 4 5.6 8 11 16
↑	↑
Shadow	Highlight
Meter	Meter
Reading	Reading
----- 6 Stops -----	
Scene Brightness Range	
2. Film Processing	
Transparency Contrast Range:	
Increase Incurred in Film	
Processing for Ektachrome is 1.7	
$6(1.7) = 10.2$	
3. Convert to density	
$10.2(.3) = 3.06$	
4. Compare with Press Window	
3.06 is too High in Contrast	
Because the Average Press Window is:	
1.8 - 2.1	

Figure 10: Example of how a daylight scene would not fit through a particular press window.

cards, and/or diffusion of the sunlight. Direct sunlight is convenient, but the ratio between light and dark is too great to be used without lighting modifiers. Photographers often measure ratios between light and dark or scene contrast on a light meter in f-stops such as f 2, 2.8, 4, 5.6, 8, 11, 16, and 22. Printers measure ratios between light and dark in photographs in density units. The scene brightness range of a typical daylight scene is commonly six f-stops, such as f-2 for the shadows and f-16 for the highlights. When a color transparency is processed, it gains additional contrast. In the case of Kodak Ektachrome film, the contrast increase is by a factor of 1.7, making the transparency contrast range a total of 10.2.

Multiply the unmodified Ektachrome transparency contrast range by .3 to obtain density units. The result is 3.06, which is extreme contrast. In one example of local conditions, a particular press, ink, and paper combination can produce a density range from approximately 1.8–2.10 (4 f-stops) and 1.2 (3 f-stops) for uncoated paper (Figure 10). If photographers limit contrast to this range, there will be less difference between the original and the reproduction and a better chance for success. In this example, the photographer could be supplied with a range of f-stops in which to conform lighting methods. In the photographic studio, lighting is under total control, so the intensity of the fill light can be increased to lower



Figure 12: A simple hand held light meter can be used to measure the lighting ratio between highlight and shadow.

the lighting ratio (Figure 11). Measuring the ratio between the highlight and the shadow created by the key and fill lights is a common procedure already in use by photographers to set up lighting equipment. Although specialized equipment, such as the fibre optic meter made by Sinar, provides greater accuracy, the same procedures can be followed with an inexpensive hand-held light meter that almost any professional photographer already owns (Figure 12). Implementing the procedure can be as simple as metering the highlight and shadow and conforming this range to local press conditions.

One major limitation of measured photography is that results often lack the visual contrast of longer-range images. Altering local contrast (such as the inclusion of small reflections which do not contain detail), in conjunction with keeping total contrast within the press window, often offers a good compromise.

An ideal image would contain

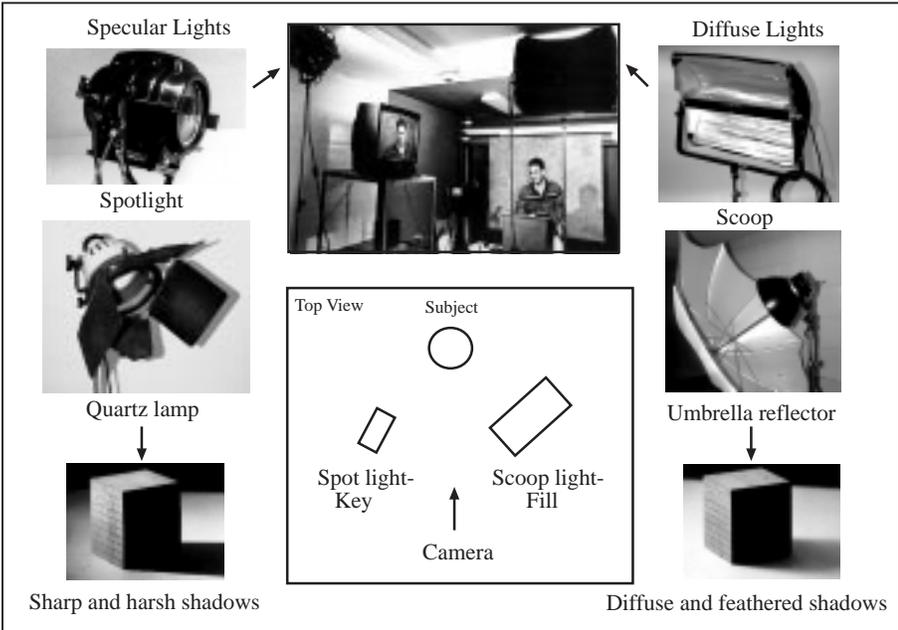


Figure 11: The key light defines the direction, shape and quality of the shadow. The fill light is dimmer, often more diffuse than the key and fills in the shadow cast by the key. The fill light intensity can be adjusted by moving the light back forth or adjustment of a light attenuator such as barn doors.

only that range of tones that can be reproduced by the printing process without compression. Based on this ideal, the greater responsibility for tonal reproduction should reside with the originator of the image. In its present form, analog photography will not ever be able to precisely match reproduction requirements for this ideal. The exposure and development of a multi-layer film does not offer the degree of precision and quality control that digital cameras have the potential to achieve. For this reason, tone control cannot rest solely in the hands of a photographer who uses conventional film. The scanner operator should be able to perform fine adjustment corrections that are not practical on the film exposure and development level.

The ideal of providing an image that precisely matches reproduction capabilities is drawing closer with the advent of low-cost and high-resolution digital cameras. When high-resolution digital cameras achieve wider adoption, measured photography standards could take on increased importance. An industry-standard tonal range, or local press conditions, could be programmed into the digital camera's microprocessor. When the lighting ratio, as detected by the CCD image in the camera, exceeds the programmed range, a gamut warning or code could be provided in the viewfinder.

It is important to realize that even with the wide range of cor-

rections and special effects possible with digital imaging, it is only possible to realistically reproduce detail that was captured at the time of exposure. This is just as important with digital imaging as it is with conventional photography. If detail in the shadow is important and the photograph contains no detail in the shadow, as is typical in a sunlit scene, no amount of digital processing can bring out detail that does not exist. However, detail can be artificially added from another source. It may also be possible to electronically enhance detail from a deep shadow in an image, which may be useful as evidence or scientific documentation, but such an image would exhibit extremely poor image quality in a commercial publishing context.

Conclusion

Technology has a great ability to blend tasks and job categories. This has especially been the case in the printing and publishing industries over the past few years. Photography can be seen as the persistent missing link in the reproduction quality control loop because of an often artificial separation between the photographer and the printer. This artificial separation will be blurred as digital imaging becomes more wide spread and when most all images originate as digital data. The potential for a new level of standardization and consistency in prepress is important. However the standardization, has not

arrived yet, in a complete sense, because of the cost and resolution factors explored earlier in this paper. In the mean time, the printer and the photographer do not have to wait for increased communication and standardization to happen as a natural consequence of the switch from film to digital. In the interim, local refinement of suggested standards, such as measured photography, can increase standardization.

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Training needs in the graphic arts industry

by Dr. Penny K. Osmond

Companies involved with computer technologies continue to struggle with the training needs created by the fast pace of technological change. The graphic arts industry is no exception. Since the original WYSIWYG (What You See Is What You Get) computer was introduced in 1984 (the Macintosh computer), the graphic arts industry has been on a fast-moving technological train that doesn't seem to be slowing down. More people are designing documents that will ultimately be printed. Training and education have become an issue for printers as well as their customers. The skills and knowledge once required only by printing technicians are now also required by the employees of printers' clients. Both printers and customers must work together to ensure that a quality printed product is produced.

A thing of the past

In pre-computer days, graphic artists created art boards using pens and pencils, in the development stages, and finalized the design with photoset type, camera-reproduced artwork, and technical pens. The final outcome was a mechanical art board that was delivered to the printer to be reproduced. If graphic elements, such as colored drawings or photographs, were to be included in the design, their locations were specified on the art board. The actual graphic elements were added later in the process. Highly skilled technicians would "mysteriously" prepare the images for print. As color desktop computers, scanners, and software have become more capable and more affordable, color reproduction has moved from the hands of the technician into the hands of the graphic artist/designer. As a result, the technical knowledge needed to accu-

rately reproduce color must also be possessed by the designer.

Technology becomes available to everyone

Today, desktop scanners and computers are used to prepare electronic files by people both inside and outside of printing companies. Powerful software programs, such as Adobe Photoshop, Adobe Illustrator, and Corel Draw, are available to create and edit graphics in ways that were cost prohibitive just ten years ago. Page-layout programs, such as Adobe PageMaker and QuarkXPress are capable of assembling text and graphics into dynamic, professional-looking documents. Quality color is more affordable and more popular than ever.

New technology brings technological nightmares as well. For example, files must now go directly from a disk to an imagesetter. Those files require skill and expertise to prepare. There are many factors to consider, such as file size, graphic file format, resolution, and color calibration. Second, transferring files from one computer to another creates problems, such as missing graphics or missing fonts. Third, files that will be printed on a printing press must first be output on an imagesetter. Properly preparing files for output to an imagesetter has been an ongoing struggle for printers whether the files are created in-house or by clients.

Training issues

Printers are struggling with two training issues: how do they provide the in-house training for their staff to keep up with technology?; and, how do they help train their customers to prepare printable files that can accurately produce color?

As more files are being created by people with little knowledge of the printing industry, printers have found it beneficial to help educate their customers in proper file preparation. For example, Eastern Rainbow, in Deary, New Hampshire, received 40% of its jobs as digital files in 1992. By 1994, 98% of its customers provided digital files (LiPetri, 1997). These customers need to learn many concepts. For example, when images are included in the design, the file size becomes larger. As a file becomes larger and more complex, the chances of it outputting successfully begin to decrease. Second, if graphics aren't properly scanned and saved, the results can be disastrous. What looks good on a computer screen may not look good on the final printed product. Third, when a designer uses a non-standard font, that font may not be available when the file is output on an imagesetter.

When files do not output as planned, the question of fault arises. Printers have found that it is in their best interest to educate customers before they actually make mistakes (LiPetri, 1997). Another benefit to providing customer training is a customer

base that becomes very loyal to the printer.

Training trends

According to a recent study by Roxin and Company, Inc., "training trends in the graphic arts industry have changed significantly in the past five years." Electronic prepress has become the standard in the industry, so the need for training has increased dramatically (Roxin, 1998). As technology changes, printers invest millions of dollars in equipment that requires employees to be trained. It used to be that a journeyman could become a master over a period of time with very little formal training. That just isn't possible today because of rapidly changing technologies. In today's competitive marketplace, employers can greatly benefit by investing in employee training to help workers learn to use increasingly technical hardware and software. Changing equipment and software can be stressful for employees. Training can help employees adjust to the technological changes in a less stressful environment.

Needs assessment

How does a company know if employee training is needed? Nancy Lowther, of Lowther Training and Development, suggests managers ask the following questions.

- How high is employee turn-

over?

- How much rework is being done on jobs?
- How many accidents have there been this year?
- How many customers have been lost because of poor service?

How can you determine if individual employees need skill training? One way is to administer skill evaluation tests. The National Association of Printers and Lithographers (NAPL) offers skill evaluation tests in three areas of desktop proficiency (White, 1995). The first test measures basic Macintosh knowledge. The second test measures individual abilities using QuarkXPress, and the third test identifies individual strengths and weaknesses using Adobe Photoshop. These tests can be used by current employees or by potential employees.

Other factors that may be worth assessing are non-skill-related traits that help determine one's performance on the job. One successful method of evaluating these factors is through the use of the Professional Dynamics Programs (PDP) from Claxton and Associates. These programs accurately predict how a candidate or employee will react in various situations by measuring at energy level, decision making style, management style, and communications style (White, 1995).

Two of the biggest factors affecting profits in a company are productivity and rework (Desk-

top for Profit, 1996). Both of these factors can be positively affected by training. So, why do companies often ignore or resist the need for training? As budgets become tight and staff is reduced, loss of productivity is a concern. According to Michael Mizen, of Michael R. Mizen and Associates, "The importance of employee training and the benefits that come from it have not been as fully recognized and appreciated in the printing industry as in other industries" (Boles, 1995). The printing industry is a fast-paced, deadline-oriented business. When problems arise, companies often look for quick fixes to get things up and running again. Loss of productivity in the short term is a concern. Larger companies are more likely to invest in training than smaller companies (Roxin, 1998). Managers of large companies often see the long term benefits of employee training more readily than managers of smaller companies who may tend to look only at the short term.

Training formats and resources

Once a company decides to provide training to either its staff or its customers, what options are available? The graphic arts industry has a wealth of opportunities for training. A survey conducted in 1994, by *American Printer* magazine and NAPL showed that training was offered in the following formats: seminars, on-the-job training, video-

tapes, workbooks, audiotapes, computer disks, and CD-ROM.

There are many training resources available to people who work in the graphic arts profession. Organizations specific to the graphic arts industry offer some excellent training options and resources. For example, the Graphic Arts Technical Foundation (GATF) provides a training program for sheet-fed press operation that includes text materials, videotapes, slides, and instructor materials. This program was designed to prepare individuals to become certified through GATF by passing written and practical tests that are administered by the employer but evaluated by GATF staff. GATF is currently working on a similar program for imaging technologies that is scheduled to be available in the spring of 1999. GATF conducts seminars for industry as well as sponsors annual training programs for graphic arts educators through Graphic Arts Educational Research Foundation (GAERF) funding.

Another resource is the GAERF, which was created in 1983 by a group of industry organizations. It has provided nearly \$4 million to projects that provide teacher training, curriculum materials, and research for the graphic arts industry.

The NAPL is a great resource for training. It currently offers industry-specific training materials through a program called "Carl Didde WorkPlace." Work-

Place is a training program designed specifically for graphic arts/printing companies that want a more efficient and productive work force. It tests and teaches skills in math computation, critical thinking and problem solving, communications, and graphic arts processes. This program can be administered by either a consultant or by an in-house human resource developer.

Printing Industries of America (PIA) provides an industry-based certification program for schools called PrintED. PrintED has a list of standards and competencies that schools must follow to become certified. Instructional materials used to teach those competencies are prepared by the individuals who deliver the instruction.

Another great resource is the International Graphic Arts Education Association (IGAEA). It conducts an annual conference for educators to attend and learn about new technologies. An added benefit is the opportunity to network with other graphic arts instructors.

Trends

Upcoming industry standards and certification may affect the future development of training programs. Funding from the U.S. Department of Education enabled the graphic arts industry to develop skills standards in imaging, press, and finishing and distribution. A program to measure press skills has been developed.

The Offset Press Operator's Multi-color Credentialing Program is the first certification exam produced from these standards (Smith, 1998). As more of these programs are developed, it is likely that training programs will become available to teach the skills.

Summary

The graphic arts industry faces two separate issues for training needs: 1) the need for in-house staff training to keep up with software and hardware technologies; and 2) the need for customer training to help properly prepare files for output. Most companies clearly see and address the need for customer training. Customer training allows printers to be more productive by reducing rework on files created by individuals outside the firm. Benefits from such training seem immediate and obvious. However, the need for in-house staff training doesn't seem to be so readily addressed. On-the-job training seems to be the primary method available to employees. This can mean a trial and error type of approach which, in turn, can lead to more waste and lower profits. There are many excellent resources available to graphic arts companies that wish to conduct in-house training. The challenge is to convince companies of the payoffs for investments in training.

As technology continues to develop, training issues within

the graphic arts industry will remain constant creating a continual need for training and development.

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Portable Document File: A versatile communications tool

by Dr. Mark Snyder

The Portable Document File (PDF) has become a hot topic. It has been so aggressively marketed, even while still in development, that perhaps it should be renamed the pre-destined format. Yet, no matter the acronym, Adobe's portable document format is rapidly emerging as one of the most significant new developments in the realm of information management. Although the early goal of PDF development was to improve document display on-screen, many other applications for this technology are being discovered or invented. Now, "PDF files serve as a digital master throughout the entire continuum of communication—from posting on the Web to outputting on a press" (Agfa, 1998, p. 1). In short, PDF files are appropriate for a variety of graphic communications applications and educators in this field would be wise to start learning as much as possible about this technology.

Background

Even though Adobe Systems Incorporated is known for the range of software it markets, perhaps the company's crowning achievement was the development of the Postscript page description language. Postscript has become the industry-wide standard technology for generating high-quality computer output. The key to its growth was device independence, meaning that the software was designed to work with almost any output device. Although successful, Postscript was not problem-free—as anyone who has experienced a "postscript error" well knows.

Postscript printing operations can be complex and memory-intensive. Printer drivers change the programming code from the

software application commands, which describe the graphics and text contained in a page, into a general-purpose programming language (Postscript) that printers understand. The stream of data produced must flow in a sequential order to the output device and access necessary data like fonts and graphics, or a Postscript error will occur. Postscript errors can also be the result of the graphic arts workflow from design to production. Various elements of a job such as vector-based designs, bitmapped images, and text are usually created in different software packages and then reassembled in a page-layout program. Unfortunately, most software applications are programmed to generate Postscript commands somewhat differently and, when combined in a page layout program, they can cause conflicts during output.

More recently, however, new versions of design software are incorporating more features that make them resemble page-layout programs. At the same time, new versions of page-layout programs are including more design capabilities to enhance their usefulness. The move toward more feature-rich graphics software seems to indicate a trend toward a more compressed digital workflow that will be less reliant on a wide variety of software applications. PDF also promises to minimize production workflows.

In September 1996, Adobe announced Postscript 3 as the

new standard for Postscript printing (Hannaford, 1997, p. 24). In Adobe's brochure, titled "Adobe Portable Document Format," the company claims that Postscript 3 will enable "higher quality output, faster processing, and a more integrated customer solution." It also "includes in-RIP (raster image processor) trapping which addresses one of the most complicated and problematic prepress steps inside and integrated with the RIP. In addition, selectable separations provide the ability to print separations . . . increasing the portion of the workflow that can be done in-house." Another factor contributing to an efficient workflow is that all Postscript 3 devices will accept PDF files for imaging.

What is PDF?

PDF is the file format first developed by Adobe for use with its Acrobat software. PDF files are independent of the authoring software, system software, and they can be opened using Macintosh, Windows, or UNIX platforms. PDF files are derived from Postscript, but are "distilled," simplified, and highly-structured. PDF files are so versatile they can be used to produce print media and digital electronic communications media. "One of the key goals of PDF is to create a more reliable file structure, reducing 'errors' by reducing the root cause—bad files" (Agfa, 1998, p. 15). Although PDF files are related to Postscript, they are

different because they can include interactive hyperlinks. PDF files are simpler than postscript files because their preparation does not rely on a programming language. Also, PDF files can be easily edited because the file structure allows software applications to access nearly any part of a document at any time (Bienz, Cohn, & Meehan, 1996, p. 33).

Although PDF was initially developed as a means for viewing documents, it actually enables any page that contains graphics and text to be transmitted, displayed, edited, and printed in a manner that is device and resolution independent. Andrew Young, CEO of the largest value-added reseller of Adobe Acrobat, wrote: "at its core, Adobe System Inc.'s portable document format represents a new genre of information management with a tool that can mold all aspects of document creation, capture, and storage, as well as internal and external distribution" (Young, 1998, p. 57).

In order to access all the features and advantages of PDF technology, the full version of Adobe Acrobat is needed. There are two segments of Acrobat: Distiller and Exchange. Distiller (Figure 1) rasterizes files and Exchange (Figure 2) is essentially an editing application for PDF files. Another Adobe product, Capture, modifies and converts scanned images into PDF files. Finally, Adobe's effective marketing scheme provides Acrobat



Figure 1

Reader software free for most computer platforms and it is incorporated into most major Web-browsers.

PDF for Web-based applications

The true beauty of PDF technology is its capability as an interactive media tool. PDF files may incorporate hyperlinking, sound linking, and Quicktime movie links. These features lend themselves well to presentation graphics typical of Web sites and enables Exchange to be used as an effective presentation software package. The abilities of PDF technology to embed fonts, pre-rasterize graphics, and provide tremendous file compression also make PDF files friendly to the Internet. PDF files can be distributed using any number of methods, such as e-mail, the



Figure 2

Web, and intranets. Adobe is doing everything it can to encourage publishing of PDF documents on the Internet, and claims that over 20 million people have downloaded Acrobat Reader (McIlroy, 1998, p. 14).

Web-based publishing uses a network to distribute documents to be output at various locations as needed. Currently, PDF technology is at its best when formatting online documents, distributing them via the World Wide Web, and printing them locally with a Postscript output device. Many organizations, including major government agencies, are beginning to use PDF in this way. For example, in 1998, the U.S. Federal Communications Commission (FCC) adopted PDF as an option for accessing selected government documents and the United States Internal Revenue Service now uses PDF to distribute tax forms.

Electronic forms collection can be facilitated by PDF technology. While PDF is commonly used to distribute documents for print output, the technology also makes it possible to move to a higher level of data management. It is possible to interactively complete forms and submit them to the appropriate agency almost immediately. The receiver can then print the form, or the data from the form can be automatically entered into database applications (Young, 1998, p.58). Will this type of technology lead to the prophetic "paperless society?" Most commercial printers

are willing to bet against that for some time to come.

Commercial printing

Proprietors of quick printing and other digital imaging printing systems and services are keenly aware of the advantages of PDF files for their business operations. "For print-on-demand service providers, PDF erases many of the current variables introduced by the variety of platforms, application programs, and printers involved in any corporate system" (Young, 1998, p. 57).

Although PDF first established its reputation through print-on-demand applications, there are also benefits for its use in the workflow of more traditional printing processes in commercial printing. For example, preflight operations are expected to be significantly reduced by PDF technology. Performance Graphics (1998) predicts that, in addition to greater output predictability, an approximate 50% time savings in file preparation will occur if PDF files become standard in the printing industry. They also report that publishing companies "are beginning to indicate their preference for PDF files over any other digital file type." Perhaps the biggest advantage of using PDF for prepress is embedded fonts and graphics—prepress operators will no longer need to spend time spent searching for missing image files.

Despite the tremendous amount of hype about PDF,

there are some very real limitations to be considered. In one of the most balanced articles written on the topic, Thad McIlroy, the president of an electronic publishing consulting company, presented a realistic perspective on the present capabilities of PDF for traditional printing applications. The article, titled *The PDF Files: Workflows that Work*, states that “. . . it may be technology just slightly ahead of its time, or, better stated, not quite ready for prime time” p. 17). Some of the “bugs” that McIlroy identifies are related to trim sizes, bleeds, hairlines, rules and borders, blank pages, process color separation (Figure 3), trapping, and total ink coverage. He defends the technology by reiterating that “PDF was originally intended as a format for viewing documents not printing them” (p. 18), yet ultimately McIlroy is optimistic that PDF will soon become a *de facto* standard in the printing industry.

Information archival systems

When you convert a document into PDF, you have a number of options for how the data

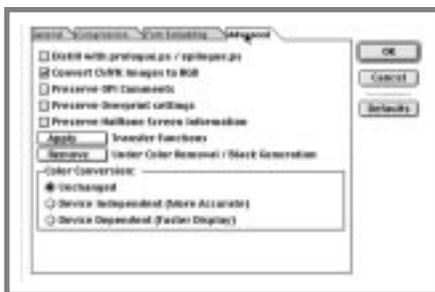


Figure 3

will be handled. Storing data on a CD-ROM, for example, may require considerably different parameters than a file to be used on the Internet (Patrick & Nordling, 1998, p. 42). It is this versatility that is PDF’s strength. Beyond the aforementioned applications, PDF also lends itself well to other revolutionary trends in the realm of graphic communications, such as information archiving and retrieval.

Storage systems, such as juke boxes, make access to vast amounts of digitally-stored data quite possible. PDF lends itself well to storage on CD-ROM and other digital data storage technologies such as magneto optical and laser discs. By improving the capabilities of digital archiving and methods for the distribution of documents, PDF technology sheds new light on the potential for concepts like virtual library systems.

It is now possible to increase access to information while providing the benefit of preserving older paper documents. Information within digitized documents will be easier to retrieve through detailed searching methods and greater numbers of people will be served at a lower cost. Small virtual libraries have already been successfully established and with considerable planning and effort traditional larger libraries are also likely to become “cybraries” (Wilson, 1998, p. 1). Of course, the process of converting libraries of traditional analog data to digital

data will be costly, time consuming, and not entirely foolproof. However, digital libraries seem to be the way of the future.

Conclusion

The portable document format is a revolutionary step forward in creating electronic documents. It is a spin-off of Adobe Systems, Inc. Postscript language, and is available for widespread use. PDF files are easily created, platform independent, self-contained, and tremendously improve the efficiency of file transfer and output.

As PDF documents and applications that read PDF files become more prevalent, new ways of creating and using PDF files will be invented. Under the heading “Seybold: PDF proliferation,” Suzanne Courteau (1998) reported: “with the growing interest in PDF, vendors expect the technology to be all the rage at . . . Seybold Seminars San Francisco/Publishing 98 show. Attendees will see the latest trends as a slew of companies announce PDF tools and compatibility upgrades” (p. 10). There are already a variety of uses for PDF, thus demonstrating its versatility.

In the field of commercial printing, “PDF remains a hugely promising but as yet unrealized technology” (McIlroy, 1998, p. 14). Although there are a number of limitations for PDF in the workflow of print production, Adobe is poised to address the apparent problems so as to fulfill

the potential that exists for it as a printing industry tool.

PDF is a true media-independent publishing format worthy of the information age. "The reason to get started with PDF today is that it will give you a head start on where you're going to have to be tomorrow" (McIlroy, 1998, p. 18). PDF has obviously not yet reached its full potential, but is well on its way. It is undoubtedly going to be a significant technology in graphic communications in the twenty-first century.

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JetScreen technology

by Phillip Canville for Professor Jerry Waite

The field of offset lithography has experienced great cost savings in the press and prepress areas over the past ten years. Most of these cost savings are due to the introduction of computer-based image manipulation programs and advances in digital file technology. Increases in computer processing speeds and improvements in page layout applications have also reduced the time required for prepress operations. Sheet-fed and web-press printers have incorporated these advances into their operations along with computer-to-plate and computer-to-press applications. In doing so, they have reduced expenses in four of the most costly areas in the industry: labor, equipment, materials cost, and disposal of hazardous waste.

Sizable labor and materials savings are being realized in the prepress and press areas because of the minimization or elimination of stripping. In particular, computer-to-plate (CTP) appli-

cations eliminate the stripping operation and reduce the amount of money spent on the purchase of photographic film and processing chemicals. Since photographic film is not an integral part of the CTP process, no expenditure for the storage of old film files is necessary. In addition, CTP reduces the cost of disposing hazardous chemicals. And, in a CTP environment, dedicated imagesetters and process cameras are no longer necessary. These cost reductions have helped offset printers realize higher profits.

Application of digital technology to screen printing

The screen printing industry has not been able to realize the cost savings attributed to many of the new digital technologies. Screen printing is one of the most hands-on and labor-intensive processes of the printing industry. Screen printers are responsible for printing on,

among other things, textiles, wallpaper, posters, billboards, ceramics, glass, and most any job printed on an irregular substrate. Unfortunately, technological changes have been slow in coming to the screen printing industry because screen printing has a lower market share than offset lithography.

Screen printers have obviously taken advantage of some of the advances in computers, image manipulation applications, raster image processors (RIPS), and imagesetters. These electronic devices handle the growing demand for processing digital images and files. However, the film positives produced by imagesetters are still mounted by hand to light sensitive, emulsion-coated screens, placed in a vacuum frame, and exposed to a high intensity UV light to set the image. Unfortunately, the screen printing industry has lacked a computer-to-screen (CTS) process similar to the CTP method used in other sectors of the print-

ing industry. If a direct-to-screen process were available, screen printers could reduce their overall operating costs. Fortunately, a new CTS process has recently been introduced.

JetScreen technology

LUSCHER, a Swiss company, recently introduced JetScreen technology to the screen printing industry. JetScreen is a CTS process that is similar to the ink jet technology used by table-top printers. JetScreen technology uses a water soluble warm-melt wax to place the image on the emulsion-coated screen. A digital image file—which can be altered up to the last minute—is loaded into the JetScreen controller. The controller converts the file into instructions that are used to guide a spray-jet head. The image is sprayed, in perfect registration ($\pm 1/1000$ inch), onto a light-sensitive stencil coating. In essence, the sprayed-on image takes the place of the film positives used in traditional screen making. After the image has been applied, the screen is exposed to high-intensity UV light to harden the non-image areas. The image areas are not hardened because the wax protects the emulsion from the light. After exposure, the wax and image areas are removed with high-pressure water leaving only the hardened non-image area on the completed screen.

Processes and materials are eliminated

Since the JetScreen process is direct-to-screen, the need for imagesetters, process cameras, film, chemicals, and stripping have been eliminated. Instead, all the processes associated with these production centers and materials are accomplished by the JetScreen. In addition, the associated labor costs and the cost for disposal of hazardous wastes have been reduced or completely eliminated. Furthermore, there is no need for a vacuum frame because it is not necessary to hold film positives in contact with the emulsion-coated screen during exposure.

Improved screen quality

Defects experienced in the traditional screen-making process—such as dot gain, tonal compression, center burn out, moiré, and the loss of detail at the edges of large screens—are reduced or eliminated because photographic processes are not used. Images are sent directly from the JetScreen controller to the wax jet head to be imaged on the screen—there are no intermediate photographic stages that can cause image degradation. Therefore, no image detail is lost or corrupted. In particular, there is no distortion of the image caused by light scatter during film exposure. Distortion is eliminated because the ink jet head is in

direct contact with the screen. Also, since there is no film-to-screen contact, there is no static build-up that may cause debris to collect on the screen before printing. To avoid the possibility of moiré in halftones, the angle of the screen mesh can be changed before the image is applied.

The thickness of the emulsion layer on the screen is important and depends on the job to be printed. Thicker stencils give extended printing life while thinner stencils are required for halftone printing. The JetScreen system will work with any thickness of screen emulsion.

JetScreens specifications

The JetScreen's maximum frame-handling capability is 63 inches by 138 inches (this is the operational area of the digital spray head). The digital jet spray head can transfer an image at the rate of one square foot per minute and produce up to a 100 lines per inch (lpi) halftone screen. At that rate, it will take about one hour to apply a 100 lpi image to a 63 × 138 inch screen. The maximum 100 lpi halftone screen produces a finer dot than most screen printing processes can currently accommodate. The finest line or dot diameter that the JetScreen can produce is 40 microns. Lines or dots this small are impractical for most screen printing applications because the ink will not be able to consistent-

ly penetrate such tiny openings. As a result, tonal values will be lost because the ink will accumulate and dry on the mesh.

Producing a stencil with a JetScreen spray head is somewhat slower than imaging a screen using film positives. However, the digital spray head is more accurate and less labor-intensive than the traditional method when multiple screens are needed or precise registration is required. Because the JetScreen produces images in precise registration, screens can be placed on the printing press with few adjustments. Therefore,

screens imaged using the JetScreen reduce makeready time and cost. This reduction in makeready time more than compensates for the additional time required to image the screen.

Conclusion

JetScreen technology is not a cure-all for the screen printing industry, but it allows screen printers to exploit some of the technological advances that have been available to the offset industry for the past few years. The ability to reduce labor, material, equipment, and chemical

disposal costs means an increase in overall profits. Profits equate to growth.

JetScreen technology is available in the U.S. through Fineline, Inc. in Ronkonkoma, New York. They have a web site on the world wide web at <http://www.fine line.com>.

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Direct to plate:

Less dot gain and other benefits

by Geoffrey Anciano for Professor Jerry Waite

Technology has touched practically all aspects of our lives. But not all advancements have been accepted with open arms: history has shown man to avoid new technologies that were either too radical or unfamiliar. Direct-to-plate printing technology appears to fit into this category. However, the benefits of direct-to-plate (DTP)—enhanced quality, environmental friendliness, higher productivity through electronic imposition, and lower production costs—are valuable enough to convert any skeptical printer.

Quality

Dr. Jerry Waite, of the University of Houston, once said, “Quality is in the eyes of the beholder...in other words, the customer decides what is a quality job.” To produce a high quality product, printers must attempt to duplicate the order as close as possible to what the client has in mind. Printers, however, en-

counter dot gain, a characteristic inherent in all major printing processes. The use of film during platemaking and the actual pressrun both tend to increase the size of halftone dots (Adams, Faux & Rieber, 1996). Although compensations can be taken into account using profiles and fingerprinting, removing a source of dot gain would certainly prove time- and cost-efficient.

Film

Using film to burn plates is still preferred throughout the printing industry. However, the potential problems affiliated with this process are numerous. Film with insufficient density can cause dot gain, dark highlight areas, and plugged-up shadow areas. On the other hand, film that is too dense can result in washed out images (Blatner & Roth, 1993). Other potential problems related to film include scratches, dimensional instability, drift factors during plate

exposure, and variations caused by alignment and stripping by hand (Maas, 1995). Direct-to-plate technology tackles these obstacles by “eliminating film, such as color separations, duplicate film and final film” to enhance image quality (Fenton, 1998). With film gone, however, the role of the printing plate becomes even more important.

Printing plates for DTP

Without the use of film to transfer images onto plates, platemaking technology has had to evolve to fit into the direct-to-plate process. For example, Kodak developed the Direct Thermal Printing Plate. While many plate suppliers use silver halide or photopolymer technologies to address the demands of direct-to-plate, the Direct Thermal Printing Plate uses thermal imaging techniques, an approach endorsed by the Graphics Arts Technical Foundation. This plate “is based on

applying focused heat from a laser diode to the surface coating on the plate until a threshold temperature is reached. At this point, an image is formed precisely as written by the platesetter. If more heat is added above the threshold, nothing happens: the image does not change. "The image is exactly as from the pre-press system with no dot gain" (Kodak Limited, 1996). Kodak claims that its plate can hold image detail and resolution of 4.8 microns, equivalent to a one percent dot at 600 lpi. But perhaps the greatest advantage deals with the Direct Thermal Printing Plate's flexibility—it can be imaged both optically and digitally. In addition, its sensitivity to only heat and ultraviolet light allows the printer to handle the plate in common plateroom safe-light conditions (Kodak, 1995).

If left unchecked, dot gain can create enormous problems for the printer. Direct-to-plate alleviates this problem by eliminating the film, thus improving the quality.

Other benefits of DTP

Direct-to-plate printing technology is more environmentally safe than conventional platemaking technology. Both traditional film processing and plate processing involve hazardous substances. Although the latter cannot be removed from the entire printing process, platemaking produces fewer toxic substances

than film processing. So the exclusion of film reduces a greater portion of the dangerous materials (Fenton, 1998).

Direct-to-plate can also result in higher imposition productivity, the process of arranging pages in the appropriate order for printing. With manual imposition, only single pages can be created and stripped together—it is quite labor intensive. On the other hand, direct-to-plate requires signatures to be imposed electronically. The result is increased productivity (Fenton, 1998). Finally, there is the benefit of lower production costs. According to Fenton (1998), "the savings can result from imposition software, decreased stripping, decreased film, decreased processing and less work in the stripping, proofing and platemaking departments."

Potential problems

In the same way that all technologies have problems, direct-to-plate runs into some snags. The first problem involves proofing. Proofing at various stages of the printing process is not only vital, but is usually required by the customer. When using film, errors can be detected and corrected in any of the many steps prior to actually burning the plates. With direct-to-plate, however, there is no way to accurately judge the image being exposed onto the plate. There is no chance to strip-in corrections

or to execute other remedies.

Another problem with direct-to-plate deals with multiple press lines. Maas (1995) states printers "that rely on multiple press lines will no longer be able to burn a negative over again for duplicate pages on other press lines. Separate plates...will be required for each press line."

The last pitfall of direct-to-plate technology is inconsistencies in plate manufacturing. "Direct-to-plate devices have to verify and correct plate-position misalignments.... Also, the number of impressions (plates) will run on the press has not yet been determined. Finally, production workers...will have to be trained to make pages on the computer in case a plate is destroyed near the end of the cycle" (Maas, 1995).

Summary

It is understandable to fear the unknown. Technological advancements throughout history have had proponents as well as opponents. But many new technologies have proven their worth in time. Direct-to-plate printing technology is another such advancement. Those who have already implemented the system have proved its benefits. Higher quality, ecological awareness, higher productivity, and lower production costs—these advantages can only be reaped by those printers who choose to adopt DTP technology.

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Digital workflow: Topics and trends in the graphics arts industry

by Harsha Paruchuri for Professor Len Leger

The trip to Graph Expo was very informative. It gave us a glimpse into the latest technologies and, more importantly, a glimpse into what technologies we can expect tomorrow. The seminars were conducted by some of the most respected names in the industry, who gave us an insight into areas that are not otherwise explored. This report attempts to gather on the insights from this show, while explaining the concept of the digital workflow and related technologies.

Abstract

The digital prepress industry has been changing so fast since its relatively recent inception, that the graphic arts industry has always had to deal with paradigm shifts in the way it works. We are now at a point where customers have pretty much accepted the digitization of workflow, and the large percentage of digital input that the printing industry now

gets is a proof of this. Digital technologies promise to change the way we work and improve our quality and productivity. This report deals with the concept of digital workflow—the technology available, the requirements that have to be met and how today's printers can adopt it.

In today's prepress, digital input is far more prevalent than the conventional mechanical copy. We are fast reaching the goal of a hundred percent digital input, which would let us take advantage of emerging new technologies which are tailored to handle the digital input, rather than trying to make the digital input fit into the existing workflow. This, and the rising customer expectations of faster turnaround times, is making the streamlining of digital workflow a very important issue for everybody in the printing industry.

The printing industry is technologically one of the fastest changing industries in the country. The most recent buzzwords

are computer-to-plate (CTP), digital printing, and digital transmission of files. These technologies are geared to increase the quality and turnaround time of our jobs. But along with these obvious benefits, they threaten to change the very way that we were used to working. Those who can adapt will reap the benefits, and those who cannot will be left by the wayside.

The usage of film in the Graphic Arts industry dates back to the time that one had to capture information from a mechanical or photograph using a camera. Now that we use have a digital description of the whole job in the form of a digital file, it is valid to question whether we have to remain with film. Film and digital files have co-existed for a substantial period of time, and we have gotten better and better results due to technological advancements both in the imaging mechanisms (imagesetters) and in the films themselves. But imaging films and re-imag-

ing the printing plates from these films is a two step process. This can be accomplished in a single step—imaging directly to plate—and this is what computer-to-plate (CTP) technology is all about. Of course, this brings up another question—why not eliminate another step by going directly to the substrate? This question will be answered in the digital printing section.

Computer-to-plate (CTP)

There are a whole lot of issues that this course of action would entail—all the actions that used to be carried out on the outputted film by the stripper before imaging the printing plates would have to be done by software before imaging it directly to the plates. These activities include trapping, imposition, etc. And there are a host of new issues, such as preflighting, digital proofing, and other quality assurance steps, because it costs more to remake a plate than to re-image a film. But there are solutions in the market now which address these issues.

Another big issue is the archival of these files. Earlier, the films used to make plates were stored, and in the event of a request for a reprint, plates were made from these films. But in the digital workflow, where there is no film, all these files have to be archived to a storage media of some sort. Many printers have taken to putting these files on

digital audio tapes (DATs) or burning the files onto CD Recordables (CD-Rs). More sophisticated approaches, like Redundant Arrays of Inexpensive Disks (RAIDs), are available to printers seeking to go completely digital.

Preflighting software, such as Extensis, Preflight Pro and Markzware's Flightcheck, are available to check files for missing fonts and images and to check parameters such as trapping and number of colors. They report any errors they find and also give the operator feedback on possible ways of correcting the problems.

There are a range of options in the imposition software market which have varying capabilities and cater to different price ranges. There are simple and easy-to-use programs like DK-&A's INposition, a QuarkXPress Xtension, which only does the imposing and uses Quark's output and color separation functions. There are complex, but more powerful, programs like Ultimate Technographic's Imposstrip which have more functions such as large folding libraries and the ability to create complex folding patterns visually. Imposstrip actually has a companion program, called Signature Server, which can handle the printing operation on a separate computer, thereby returning control of the workstation to the operator almost immediately after the print command is issued. Most

of these programs handle input in the form of PostScript, TIFF, EPS, and PDF formats.

Digital proofing is an issue that has been around for some time now. There are various solutions catering to a range of markets—large and small. Solutions range from hundreds of thousands of dollars (Kodak Approval) to low-cost ink-jet proofers. Imation is now making digital Matchprint substrates, which can be used right on the platesetter. One of the major advantages of this is that the same RIP that interprets the job and images the plate images the proof too. This makes for a much more reliable proof.

Platesetters have a distinct advantage over film, due to the fact that the plates they make are first-generation exposures. Therefore, dots are much sharper, and smaller dot sizes can be supported. With the announcement of processless plates at IPEX 98, in Birmingham, CTP promises to shave even more time off the print cycle.

Digital presses

Digital presses can be classified into two categories—those which cannot print variable data and those which can. The first category, of course, was defined by the Heidelberg GTO DI, which used the Presstek thermal ablation plates. Recently there have been new additions to this category—the KBA-Planeta/

Scitex 74 Karat press and the Screen TruePress. These presses are different from the DI in that they have reduced operator skill requirements to a minimum. The Karat press, for instance, uses a mechanism that eliminates the need for ink keys, thereby reducing the dependency on the operator's skills. These presses are not all that far removed from conventional presses, and cost significantly more than a conventional press with similar specifications. The level of control and automation of these presses is impressive, and they hold some advantages for quick printers with relatively short run jobs. But for printers who have a good press operator, the extra investment in these fixed data digital presses does not make too much sense.

On the other hand, there are digital marking engines, which don't have a physical master, and can produce a different image for every impression. A large number of these digital presses are based on an engine developed by Xeikon. The other major player is Indigo, with the E-Print digital press. In my opinion, the major advantage that sets these digital presses apart from their conventional counterparts is their capability for variable printing, and of course, their economic viability in the very short run-length market. In this information age of one-to-one marketing, this capability of variable printing is very attractive.

One might, as mentioned

above, ask why one should not go completely digital, eliminating not only film, but also plates. The reason is that the digital presses, especially the variable data presses, have not yet caught up with the conventional presses in terms of quality. More importantly, the cost of digital printing is not even close to competitive at longer run lengths compared to conventional lithography.

Most of the issues that need to be addressed in a digital printing scenario are the same as the ones that were discussed in the CTP case. Preflighting, trapping, imposition, and proofing—all are issues that need to be resolved. Of course, the topic of variable printing brings up the importance of being able to handle databases and interface them with the digital printers. Though there are quite a few programs out in the market that allow input of text from databases. There is higher-end merging software too, which allows pre-RIPped images and text from a database to be put into documents on demand. However these are not in widespread use.

Digital front-ends/ workflow automation systems

To manage all these changes and integrate them into the workflow, it takes a visible effort on everybody's part to change. There are a slew of vendors who have recently come out with or are coming out with workflow

solutions, such as Scitex's Brisque, Screen's TaigaSPACE, and Heidelberg Prepress' Delta. These software packages handle everything from job tracking to trapping to imposition to RIPping and outputting to various output devices. The obvious advantages are that a single RIP drives output devices, due to which the output from one device matches the other better (eg: proofs match the plates). Even though these front ends are designed to handle multiple output devices from various vendors, it is not presumptuous to assume that they will work best with output devices manufactured by the same vendor. For example, a printer is assured that a Brisque front-end will be perfectly compatible with an Iris proofer, a Dolev imagesetter, a Lotem platesetter, and maybe even a Spontane digital press. Screen takes it further with their TaigaSPACE workflow automation system, which is specifically set up for Screen output devices. It is interesting to note that this, in a way, is a return to the proprietary workshops in the print industry in the 70's—but of course, with much more open standards.

Digital transmission technologies

The rapid advancement of technology in other fields of endeavor have also affected the pace of advance in the printing industry. Advancements in the

telecommunications industry have provided us with networking solutions in the past and are now providing us with solutions for the fast digital transfer of files from the customer to the printer. Networking of workstations with servers and output devices has been in the industry for over a decade now. It is used to provide services ranging from something as basic as printing to a network printer to advanced techniques employed by the Open Prepress Interface (OPI). OPI deals with storing high resolution images (composite or separated) on the server and using low resolution for position only (FPO) images in the layouts, which would be swapped back with the hi-rez images at the server before RIPping. Networking is a prerequisite for the CTP and digital printing scenarios that are mentioned above. Now the telecom industry is offering a solution to the ever-increasing demands of customers for faster turnaround by providing high speed communication lines, such as ISDN and T1, for the transfer of digital files. This digital transmission of data files through high band-

width lines is supplanting the physical transport of data disks. Customers see their ability to send files to the printer instantaneously as a major advantage of the printing company. Even more importantly, rapid transfer of last minute corrections before the printing makes the relatively high cost of leased communication line worth it.

“Connectivity can be achieved by dedicated point-to-point leased lines (T1 and T3), switched services (ISDN), or routed services (Wam!Net, Internet, ATM, frame relay and satellite)” (D. Pope, *Publish*, August 1998). ISDN usually has a fixed monthly fee associated with it, and the time used has to be paid for per minute. Long-distance charges are also involved. But this is comparatively cheap, and it provides a fixed bandwidth that does not depend on conditions such as Internet congestion, etc. T1 and T3 lines have much higher bandwidth, but, on the other hand, they also cost more, and are affected by Internet congestion.

There are also companies that cater specifically to the printing

industry’s transmission line needs, such as Wam!Net, Digital Art Exchange (DAX), and others. These managed communication services take the hassle of direct management of these communication lines off the printers back. They also offer such value-added services as on-site proofing. The digital file is sent from the printer to the service providers location closest to the customer, and a proof is made there and handed over to the customer.

Conclusion

The printing industry is fast moving towards a completely digital workflow. The questions that printers need to ask themselves include: whether the prerequisites for this workflow are in place and whether they and their employees are prepared for the change. There are many technologies in the market that provide a path to a digital workflow. The printer has to decide which one (or which ones) are appropriate for him.

Six degrees of separation:

A look at the hexachrome™ high fidelity color reproduction system

by Scott Fry for Professor Dan Wilson

A broadening of the gamut of reproducible process colors would be welcomed by the printing industry. The quest for better process inks have been a step in the right direction but still has not produced “perfect” inks. With the advent of extra-ternary color separations (more than three primary colorants) printers have been exploring the possibilities by which colors gamuts could be expanded (Lamparter, 1994, p. 52–3). The Hexachrome™ system from PANTONE® has offered one viable solution for printers who want to expand their color capabilities. This package, consisting of a few software plug-ins, plus a calibration program, will allow printers to reproduce a broader color space with only minor changes in prepress workflow.

The term hi-fi color (short for high fidelity color) was coined by Don Carli as a comparison to high fidelity stereo equipment, which reproduces sound with little distortion (Jeffrey, 1995 p.

46). A hi-fi color reproduction system dates back to 1972, when it was devised by Harald Küpper. His theory was to increase the printable gamut by using cleaner ink pigments and adding orange, green and violet. This system was researched by German ink manufacturers who developed the Küpper colorant set. Other high fidelity systems, like the Davis Hi-Fi Color Project, use CMYK +RGV inks to expand the color gamut (Lamparter, 1994, p. 53). A system by DuPont, called HyperColor, uses only CMYK inks to reproduce an image. However, HyperColor achieves its expanded color gamut by increasing ink film density. “Bump plates” are added to printing units to print additional layers of ink in one or all four colors (Whitcher, 1998, p. 70).

PANTONE introduced Hexachrome in 1994. This color reproduction system takes the basic CMYK inks, reformulates them, and adds green and orange inks to the process (Hexachrome

Q&A, 1998, p. 1–4). The addition of these two colors to the reproduction process allows Hexachrome to exceed the RGB spectrum in all but the green area of the spectrum (see Figure 1.1). Through this system, offset printers can now reproduce colors beyond the gamut of the monitor and even into the fluorescent and pastel range (Jeffrey, 1995 p. 46). In addition to this, Hexachrome can accurately reproduce 90% of all PANTONE spot colors, compared to the 55% of matches available from conventional CMYK process (Wilson, 1995, p. 31).

Installation of Hexachrome

To produce Hexachrome separations, the minimum desktop requirements are a PowerPC or 68040 or better Macintosh, Adobe Photoshop 3.0 or later, and a page layout application capable of placing a DCS 2.0 file. As it currently stands, PANTONE only manufactures this

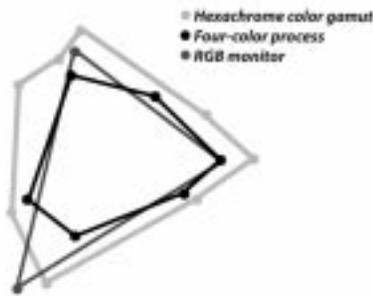


Figure 1.1. Hexachrome color gamut

system for the Macintosh platform (Studio Soft, 1996, p. 2.4).

Three main components are loaded during the installation of the PANTONE HexWrench software. First loaded is SAME (Studio Appearance Matching Environment), a control panel which acts like a color management tool for the purpose of compensating color differences between input devices, output devices, and monitors (Mac World, 1998, p. 46).

Second loaded is HexWrench, which consists of two Photoshop plug-ins. These plug-ins are what allow the six-way separation to occur. The biggest advantage that these plug-ins offer is the ability to control the separation process. Users can select image segments and alter the separation settings and then view the effect via soft proof. Differences between coated and uncoated paper, total ink limit, screening and even CMYK vs. Hexachrome can all be proofed on screen before any separation takes place (Studio Soft, 1996, p. 5.1–5.14).

The hard drive contains the HexWrench folder, which consists of a PDF manual and the third piece of the puzzle: HexWrench Tuner. This is the calibrator of the system. After printing a control swatch, measurements can be taken from each patch with a ColorTron or Spectroliner colorimeter to create an ICC profile, which HexWrench then uses to create separations. The result of this calibration is what HexWrench uses to determine dot gain compensation (Studio Soft, 1996, p. 6.2–6.10).

Hexachrome workflow

With these software elements in place, the Hexachrome workflow can begin. Scanning and image capture can be performed as usual, but all images must remain in RGB space. If images were to be transformed into CMYK at any point, their viability

would be lost due to gamut clipping (Hexachrome Q&A, 1996, p. 4). Changing the color space of an image from RGB to CMYK can result in a 25% reduction in color range (Whitcher, 1998, p. 70). No special alterations are necessary during the image manipulation process. Color casts, sharpening, and all other image correction techniques are unaffected by Hexachrome (Hexachrome Q&A, 1996, p. 4).

Once an RGB image is ready to undergo separation, pulling down the “filter” menu and going to “color” will initiate the HexWrench plug-in. Here a control window appears, displaying the image and the settings for creating separations (see Figure 1.2). This is where the user may select whether they want to create an image screened at 175 lpi, 200 lpi, 14 μ or 21 μ stochastic. The user also selects coated or uncoated paper and adjusts the total

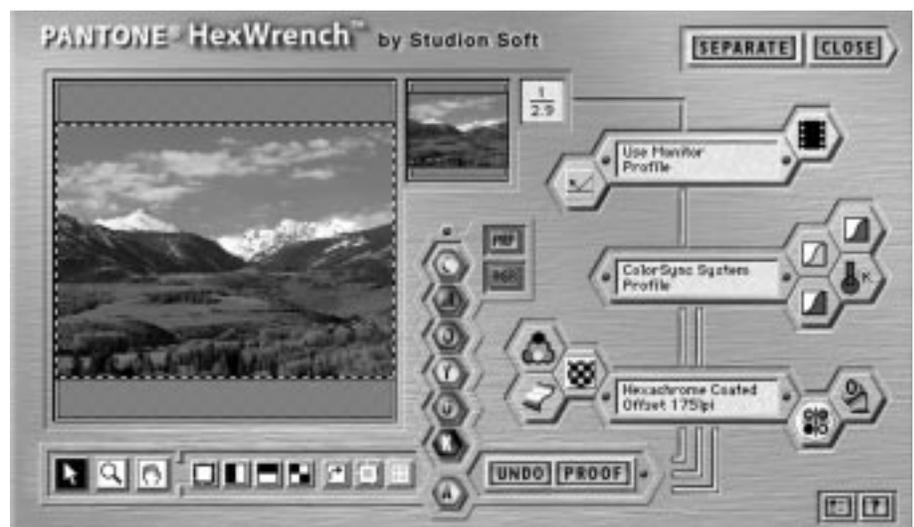


Figure 1.2. Creating separations with Pantone HexWrench

ink limit (which PANTONE calls the black modifier). Information about the origin of the image is also specified. HexWrench inquires as to the nature of the original media, reflection or transmission and which scanner profile captured the image, allowing SAME to compensate for color variation.

After the settings have been changed to their correct positions, a set of separations are generated by clicking the "separate" button. After the separation process is complete, seven files will appear on the desktop. Six of these files are color channels and one file is a DCS 2.0 that can be placed into almost any page layout application (Studion Soft, 1996, p. 5.1-5.14).

With the release of new application versions that support Hexachrome, a less complex workflow is available. While image capture and manipulation still follow the same procedures, rather than creating separations out of Photoshop they are made upon output from a page layout application. With Hexachrome supported software, RGB images can be placed directly into the application. Once placed, programs like QuarkXPress 4.0, Adobe PageMaker 6.5, Corel Draw and Macromedia Freehand 7.0 will automatically create separations. The advantage of this workflow is that the user is required to perform fewer steps. However this is also the workflow's disadvantage because few-

er controls are available regarding the nature by which the images will be separated (Moretta, 1998, p. 6-8).

Proofing concerns

Proofing systems are available for Hexachrome, but mainly in analog form. Agfa, Dupont, Fuji, and TransCal are the major suppliers of proofing materials for the Hexachrome System (Hexachrome Q&A, 1998, p.4). Digital proofs can be made to simulate Hexachrome output. Some digital color output devices have a gamut that is over 50% greater than conventional process color work. For example, the gamut of the Scitex Iris proofing system for example, encompasses almost all of the Hexachrome gamut, making it an acceptable digital proof for hi-fi color (Andersson, 1998, p. 21). The Epson Stylus Pro 5000 can also be used to create Hexachrome proofs. Both of these printers can give designers an idea of what the printed result will look like. However they are not considered a contract grade proof (Whitcher, 1998, p. 70).

Hexachrome calibration

HexWrench Tuner is a stand-alone application that produces ICC profiles for presses. The creation of a profile is critical to producing good Hexachrome separations. The profile for the target device is asked for when

creating separations in HexWrench. This is the only way that dot gain compensation can occur. By reading the test patches with a ColorTron or Sepectro-line colorimeter, the profile will be built and incorporated into the SAME list of profiles (Studion Soft, 1996, p. 6.2-6.10). Profiles are also requested in making separations from QuarkXPress 4.0 and any other Hexachrome compatible software that integrates color management directly into the application (Anderson, 1998, p. 12).

Press considerations

When someone uses the term "hi-fi color," the thought of a six-color press printing stochastic screens comes to mind. With this scenario comes some serious press concerns. While many printers assume that stochastic screening is used exclusively for hi-fi, this is not the case. Hexachrome repeats two of the screen angles to eliminate a moiré pattern with conventional screens. Orange is printed at the same angle as cyan. Green is printed at the same angle as magenta (Whitcher, 1998, p. 69).

Another substantial concern to experienced lithographers is how to control the total ink limit. To print a total possible 600% ink film would represent a nearly impossible task with the marking, picking, curling, and drying difficulties that would occur.

Unfortunately, this is a weakness of Hexachrome. The black modifier in the HexWrench plug-in is the only place that the total ink film can be regulated. Here, only three options are possible: from normal (0); thin (-2) and thick (+2) (Studion Soft, 1996, p. 5.10).

One aspect of Hexachrome that experienced lithographers will appreciate is its ease of color modification on press. For example, press operators can enrich the greens in a reproduction of a lush woodland scene by increasing the amount of green ink. This is significantly easier than increasing cyan and yellow. By only altering one color, operators will not have to be concerned with changing an image's gray balance (Jeffrey, 1995 p. 48).

The standard process color inks used in conventional color printing cannot be used in the Hexachrome process. PANTONE specifies a set of special Hexachrome process inks that must be used for this process to properly achieve the expanded gamut. According to PANTONE, these inks have been reformulated for more than the purpose of tack control and wet ink trapping. PANTONE research and development experts experimented to find cleaner process inks. Through testing, an optimum formulation was found by combining fluorescent and conventional pigments. For example, Hexachrome yellow is composed of the traditional Diarylide yel-

low pigment, but with the addition of fluorescent pigments. This yellow has more than double the lightfastness of its traditional counterpart. Hexachrome magenta is based on the rubine pigment (rather than rodamine), but with the addition of fluorescent pigments. Cyan is without fluorescent pigments as its purity was increased by reformulation, yielding 20% more potency. Green and black are also without fluorescent pigments.

Despite the relative simplicity that this system offers on the desktop, Hexachrome perhaps most significantly represents an advancement in ink formulation (Lustig, 1998, p. 82). The importance of this innovation in ink is that printers who only choose to run the reformulated CMYK inks can still benefit from an increased color gamut (Jeffrey, 1995 p. 47). For a six color press the suggested run sequence is black, cyan, green, magenta, yellow and orange (Studion Soft, 1998, p. 7.1).

The Hi-Fi debate

But why bother with hi-fi color? Some among the industry believe that Hexachrome and other hi-fi color systems are just a gimmick and will never become commercially successful (Lamparter, 1994, p. 53). A commonly held opinion is that modern presses are printing better color images at higher resolutions than ever. Along with new technolo-

gies, like stochastic screening and waterless lithography, there is no justification for the modified workflow and increased budgeted hourly rates that six color process printing would require (p.54). Some experts believe that for a magazine, a switch to hi-fi color could add an extra 20% to their printing cost (Wilson, 1995, p. 31).

Others among the industry recognize that there has been, and always will be, a market for printing of the highest caliber. For example, educational publishers are starting to use hi-fi to create bold textbook covers. A vivid design on the cover a math or reading book attracts the attention of its end users—children and teenagers. Some print customers can actually save money using hi-fi color. For example, clients who specify multiple spot colors can save money by running hi-fi because of the number of spot colors that it can reproduce. (Whitcher, 1998 p. 70). Another economic advantage of hi-fi color, according to PANTONE, is savings made in paper buying. Printing can be done on lower priced, cheaper grades of paper, and, due to hi-fi's vibrant color, can still result in high production quality (Wilson, 1995 p. 31).

For now, hi-fi color is considered by most to be a niche. Mark Tennant of Anderson Litho, a Hexachrome beta test site, says "Our clients have the highest demands and are willing to move

beyond four-color process if it differentiates their products” (Jeffrey, 1995 p. 46). In the final analysis according to Mills Davis, “...it’s like high tech gas at the pump: it costs more, but not a lot more” (Wilson, 1995 p. 31).

Final thoughts

In this age of increasing digital technology, print customers are demanding more out of a traditional media. Printing must strive to meet the new expectations of its customers. High fidelity printing is a step in this direction. Traditional print customers are interested in the cutting edge that this new vibrant color can give their products and images. As this market steadily grows and high fidelity print becomes more commonplace, printers will be forced to take a second look at this process. Competitive printers have already adapted their workflow

and print all or most of their products with hi-fi. Realizing the opportunity to give their customers a value added service has kept them up to date in an ever changing market.

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