

Visual Communications Journal

2001

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Visual Communications Journal

Editor—Jerry J. Waite

Assistant Editor—Jaclyn T. Waite

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Jurors: Ervin A. Dennis, Z.A. Prust, Charles Johnson

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How We Produced the Journal

All articles were submitted electronically in the Microsoft Word format. All photographs were submitted digitally and were edited and converted to grayscale using Adobe Photoshop. Graphs and tables were printed from Microsoft Word and Excel to PostScript print files. Then, the print files were opened in Adobe Illustrator and converted to the encapsulated Post Script (eps) format. Page layout and text editing, using variations of Adobe Caslon type, were accomplished using QuarkXPress. The file was converted to a press-optimized pdf which was then e-mailed to Western Wisconsin Technical College for imagesetting, platemaking, printing, and binding.

About the Journal

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

Please follow the guidelines provided on page 61 of this *Journal*.

Membership and Subscription Information

Information about membership in the Association or subscription to the Journal should be directed to:

IGAEA Second Vice-President
200 Deer Run Rd.
Sewickley, PA 15143

President

David W. Dailey

Department of Technology
Eastern Kentucky University
307 Whalin Technology Complex
521 Lancaster Ave. • Richmond, KY 40475-3102
606-623-7180 Home
606-622-1190 School • 606-622-6274 FAX
tecdaille@acs.uky.edu

President-Elect

Richard Grim

Applied Engineering and Technology
California University of Pennsylvania
250 University Avenue. • California, PA 15419 •
724-938-8707 Home • 724-938-4085 School •
724-938-4572 FAX • grim@cup.edu

First Vice-President

Jerry J. Waite

Industrial Technology Department
University of Houston
Building T2 Room 309
Houston, TX 77204-4083
281-565-2013 Home • 713-743-4089 School
713-743-4032 FAX • jwaite@uh.edu

Second Vice-President

Dennis B. Dougherty

Thaddeus Stevens College of Technology
750 E. King Street • Lancaster, PA 17602
717-733-4420 Home • 717-299-7767 School
717-299-7748 FAX • dougherty@desupernet.net

Secretary

Margo Booth

McIntosh High School
1211 Greer's Trail • Peachtree City, GA 30269
770-487-8084 Home
770-631-3232, ext. 202 School
770-631-3279 FAX
mhsgraphics@mindspring.com

Treasurer

Evan G. Jackson

Bayside High School
4960 Haygood Road • Virginia Beach, VA 23455
757-428-8975 Home • 757-473-5050 School
757-437-4999 FAX • ejackson@pen.k12.va.us

Immediate Past-President

Daniel T. McCluskey

Willowbrook High School
1250 S. Ardmore Ave. • Villa Park, IL 60181
630-530-3693 School • 630-530-3401 FAX
dmcegraph@aol.com

Editor's Note

IGAEA members and their students did a first-class job in 2000–2001! The quality of the articles submitted were the best since I've been editor. In addition, the *Journal's* content is interesting, timely,



and, I'm sure, offers something to each of our IGAEA members.

In particular, I'd like to point out the four refereed articles in this year's issue. The *Visual Communications Journal* editors started offering refereed-article service to IGAEA members in 1999, and our first two refereed articles were

published in 2000. In case you are not aware of the referee process, it involves a blind review of each article by a jury of graphic communications professors. For 2001, the jury included well known authors Ervin A. Dennis, Z.A. Prust, and Charles Johnson. To be considered refereed, an article must report new empirical research. In addition, all three of the jurors had to consider the article important and approve of the methodology the author(s) used during the study and subsequent reporting. For a professor, the vote by peers to judge an article as "refereed" is among the highest of compliments and is a major achievement. Congratulations to Daniel Wilson, Harvey Robert Levenson, Yung-Cheng Hsieh, and the team of Lesta A. Burgess, Teresa J.K. Hall, and Shahram Varzavand for a job well done.

The *Visual Communications Journal* has been accepting articles from students of IGAEA members for a number of years. Even though this service was widely publicized using the Graphic Comm Central listserv and in *The Communicator* newsletter, only Charles Johnson and I submitted papers in 2001. I am very proud of the student articles: they represent the highest form of the

graphic artist's profession: teaching one's students or apprentices to be scholars as we teach them to express their ideas—and the ideas of others—graphically. I struggled with the idea of including three of my students' articles. However, I decided that the three papers were well written, their content was timely, and they could serve as useful handouts for IGAEA members to use in their classes. To carry on the tradition of publishing student work in the *Journal*, I strongly recommend that IGAEA higher-education members consider submitting their students' papers to this publication.

This year, the minds of our writers seemed, as always, to be focused on the future. For example, Levenson reported on the status of patents in the graphic arts. Overall, Levenson envisions a strong and bright future for graphic arts innovation and invention, especially for technologies that reduce the waste of high-cost disposable commodities such as paper. However, he cautions that "those with novel ideas about graphic communication technology had better act rapidly in securing (patent) protection because someone else is probably working on the same idea."

Wilson, in his article, and Burgess, Hall, and Varzavand, in their paper, look at graphic communications curriculum issues. Wilson provides a thorough industry analysis of the printing industry in Pennsylvania: its findings may surprise you! In essence, his study focused on the way things are in the printing industry and what printers expect and need from graphic communications curricula. Burgess, Hall, and Varzavand studied the perceptions of students at the University of Northern Iowa with regards to their perceived need to know—and knowledge of—digital graphic communications media. Their paper provides a look at what students want and need from their graphic communications curricula. Interestingly, the two outlooks—those of printers and students—are not nearly the same. In fact, the students seem to be

much more forward-looking than the printers, a phenomenon I have witnessed first hand here in Houston. The challenge for graphic arts instructors is to effectively meld printers' needs with student wants into a comprehensive curriculum that serves both present and future requirements.

In synchronization with the findings of Burgess, Hall, and Varzavand, two student articles look at digital graphic communications technologies. Goncarovs, Zarzycka, and Villafranca offer a step-by-step guide to put a printing business online. Higareda explains how two technologies allow individuals to get online without wires.

Yung-Cheng Hsieh once again provides an in-depth empirical look at printing variables. For 2001, he looked at how dot reproduction is affected by various computer-to-plate (CTP) materials and processes as compared to traditional presensitized plate technology. What he concluded is rather troublesome: there's very little consistency between different types of CTP materials: solid ink densities, dot gain at 75%, 50%, and 25%, and print contrast all varied significantly from one CTP material to another. Printers adopting CTP technology, therefore, must calibrate their systems carefully and not vary materials or prescribed settings if consistent printing is to be accomplished.

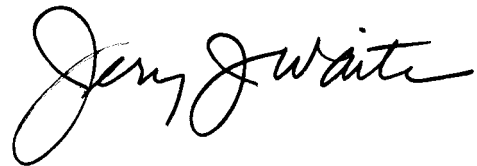
Osmond and Majeske provide practical procedures to utilize digital technologies. Osmond provides insights into the use of the ubiquitous pdf file, while Majeske shares his experiences using multimedia equipment to provide his students with virtual field trips (Majeske's paper gave me just the motivation I needed to capture a recent field trip with a digital video camera. I intend to

edit it with iMovie soon!). One of my students, Daniel Rodriguez, also provides some practical recommendations in his article on maximizing electronic prepress efficiency.

Mengtsung Tai, a student of Professor Charles Johnson, provides what should be a required hand-out for all graphic communications students: a thorough description of proper names and uses for various graphic elements found in publications. I know that I'm putting that article on my website for my students to read

All in all, I found the articles in the 2001 *Visual Communications Journal* to be both enlightening and helpful. I hope that you will also find them informative and that you'll consider making them available to your students. If you'd like to link your website to a pdf version of this journal, create a link that points viewers to www.igaea.org. Once at the IGAEA site, an additional link can be used to display several back issues of the *Visual Communications Journal*.

In closing, I'd really like to thank Ervin Dennis, Z.A. Prust, and Charles Johnson for serving as jurors. It is always rewarding to work with such thoughtful individuals. I'd also like to thank my daughter Jaclyn who spent many hours helping me edit. Jackie, I could not have done it without you.



A Needs Assessment: Implications for Graphic Communications Education

Daniel G. Wilson

*Department of Communication Arts
Pennsylvania College of Technology*

Introduction

Quickly evolving technologies continue to affect nearly every aspect of graphic communications. Educators are charged with maintaining up-to-date and relevant curriculums that best prepare their students for employment in the business sector. With such rapid change occurring over such a short time, curriculum development remains a continual challenge for educators. To make matters more complicated, not all graphic communications businesses have embraced the most modern digital workflows. Many are balancing traditional technologies with modern computer-based systems; educators must therefore prepare students who can perform in a variety of technological environments. With so much potential content to teach and with limited credit hours to devote to technological subjects, educators must have access to data that help them focus their curriculums on relevant material.

Theoretical Background

In general, the development of instruction begins with the identification of a need (Dick, Carey, & Carey, 2000). The process of needs assessment provides a means for defining the gaps between current results and desired results, ultimately providing the justification for identifying and choosing solutions that close the gap (Kaufman, 1994). Needs assessments are required when an organization wishes to know the extent to which performance is successful and the extent to which it is not. A model championed by Roger Kaufman (1994) of the Center for Needs Assessment and Planning at Florida State University involves taking a pragmatic approach in defining three levels of need. The first level of concern, a mega-level need, relates to broad matters like societal payoffs and quality of life. The

second level of concern, the macro-level, focuses on needs specifically within the organization (school, department, etc.). The third level of concern, the micro-level, examines needs at the individual level. A complete needs assessment involves a collection of data from a variety of sources, with the ultimate goal of maximizing curricular relevance and quality at all three levels of concern. Examined in this light, improvement in instruction may be less concerned with content or equipment, than with personnel, philosophies, and approaches.

A needs assessment involves two processes: one examines desired results through strategic planning; the other examines the current status of results through the collection of soft and hard data. Soft data are perception-based and collected through interviews; as such they entail personal and private information. Hard data are typically numerically-based and independently verifiable (Triner, Greenberry, & Watkins, 1996). In the case of a needs assessment for a graphic communications program, sources for data collection might include potential students, current students, graduates of the program, educators outside the institution, literature reviews, and potential employers. The data-gathering venues may be as diverse as personal interviews, phone interviews, or survey instruments. Once completed, faculty or other curriculum specialists have a wealth of information to serve as a backdrop for the development of relevant instruction.

The Needs Assessment

In the spring of 2000, an extensive needs assessment was performed for the printing and publishing technology programs at the Pennsylvania College of Technology. College policy requires that this process be undertaken once every five years for every academic program at the insti-

tution. The results of the needs assessment provide a source of data to inform diverse decisions on curriculum revisions, lab development initiatives, recruitment initiatives, library needs, staffing needs, and funding allocation. The needs assessment process undertaken sought to gather data from current students, graduates of the programs, leaders among Pennsylvania's printing industry, and literature reviews focusing on current trends in the printing industry. The specific data presented in this publication are derived from a survey sent to representatives of Pennsylvania's printing industry. The data presented in this study comprise only a small portion of the total data required for a full needs assessment; however, data here presented may be useful for educators looking for additional information sources to validate their curricular decisions.

Research Questions

The instrument was developed to help answer a number of research questions—identified by Pennsylvania College of Technology faculty and the program advisory board—that address curricular issues facing the program. While many other issues may well have been addressed, the faculty and advisory board decided to keep the questions narrowly focused, creating a short survey instrument capable of achieving an adequate return. Seven research questions emerged as a result of extensive discussion.

1. How close is the industry to embracing a computer-to-plate workflow? This question was asked to help clarify the emphasis that should be placed on traditional prepress tasks such as film processing, film assembly, and analog proofing.
2. How prevalent is process color work in the printing industry? This question was asked to help clarify the degree of emphasis to place on color reproduction tasks at the two-year degree level.
3. Which computer operating system is used most prevalently for printing production processes? This question was asked mindful of the fact that much instruction is devoted to operating system issues and in anticipation that the resulting data could guide decisions for new computer purchases.

4. Which page layout software program is most prevalently used in the printing production process? This question was asked to determine which software packages should be taught and to what extent.
5. Which printing production jobs are in most demand? This question was asked to help validate the program's current emphasis on production and to help advise students concerning the most realistic employment opportunities.
6. Which printing management-oriented jobs are in most demand? This question was asked to help validate the program's management emphasis and to help advise students on those career opportunities that focus on management-oriented functions.
7. Do printing industry executives perceive a need for college-level degrees specializing in graphic communications? This question arose from the need to provide data that validate the continued offering of programs in printing and publishing technology and production at Pennsylvania College of Technology.

The Survey

A total of 470 surveys were mailed to printing companies within the state of Pennsylvania. Each was addressed to the top executive in the company. Fifty usable surveys were returned (10 of the 60 surveys returned were improperly completed) making for an 11% response rate. The survey was designed as a four-page, 8.5 × 11 inch trim self-mailer. Business reply status allowed the respondent to return the survey for free. A cover letter explaining the importance of the study and information about the printing and publishing technology programs at Pennsylvania College of Technology was incorporated into the design. To encourage a high response rate, check box-type answers assured that responses could be provided quickly, accurately, and with minimal effort. No follow-up survey was mailed.

Limitations

The survey instrument was designed to solicit data on the needs of a sample of Pennsylvania's printing industry. Two key limitations of this study

are described below:

1. The sample of survey recipients was derived from a database supplied by the Graphic Arts Association (PIA's Pennsylvania affiliate), and therefore may not be random and representative of the entire population.
2. All survey respondents were lithographers; therefore, the results may not reflect the needs of service bureaus, flexographers, screen printers, gravure printers, or digital on-demand printers.

Data Analysis

1. How close is the industry to embracing a computer-to-plate (CTP) workflow? A total of 72% of the printers surveyed still strip multiple one-piece films into flats for plate-making. However, 36% of those printers strip multiple films for a minority of their jobs, opting for fully imposed one-piece films or bypassing film for computer-to-plate for the remainder of their jobs. The data suggest, however, that traditional stripping skills are still required in the printing industry (see Table 1).

As indicated, 80% of printers output fully imposed one-piece films, ready for platemaking. These data suggest that a majority of printers are using a digital workflow that includes large-format imagesetters, necessitating the operations of pre-flight, file repair, digital imposition, digital trapping, and network servers.

Of those printers surveyed, 30% are employing computer-to-plate technologies. Interestingly, none of the CTP printers use computer-to-plate technology 100% of the time. This suggests that these printers may have customers that insist on film for

	Percentage of Total Work				
	0%	25%	50%	75%	100%
Film Stripping	28%	36%	10%	6%	20%
One-Piece Film	20%	20%	20%	20%	20%
CTP	70%	10%	4%	16%	0%

Table 1: Image Assembly and Platemaking Workflow

	Years				
	< 1	1 - 2	2 - 3	3 - 5	> 5
Printers Responding	28%	10%	24%	10%	28%

Table 2: Estimated Time to Purchase Computer-to-Plate Equipment

proofs, use films for reprints, or receive customer-supplied films. In any case, the results do show that film still plays a major role in the lithographic printing production process.

When those printers who have not yet switched to CTP were asked when they will do so, 28% indicated they would do so within the year; 10% indicated plans to purchase CTP technology within one to two years, and 24% indicated that they would do so within two to three years. The remaining 38% indicated they had no plans to switch for at least another three or more years (see Table 2).

2. How prevalent is full process color work in the printing industry? Of the printers surveyed, 68% print some one-color jobs with the remaining 32% printing no work in a single color. Respondents were not asked what process they used for these one color jobs, though one may assume that many are printed by xerographic methods and not by lithography. Of the printers surveyed, 90% indicated customer orders for two- and three-color jobs; 90% print process-color work. Additionally, 52% of all printers responding indicate that over 50% of customer orders are for process-color work.

These results show that the use of process color is prevalent and comprises a very high portion of

Jobs	Percentage of Total Work				
	0%	25%	50%	75%	100%
One-Color	32%	48%	8%	12%	0%
Two- or Three-Color	10%	50%	32%	8%	0%
Process-Color	10%	38%	20%	24%	8%

Table 3: Color Requirements as a Percentage of Total Work

all printing work. These data suggest that color-reproduction theory and practice should play an important role in the graphic communications curriculum (see Table 3).

- Which computer operating system is used most prevalently in the printing production processes? Respondents were asked to indicate the percentage of production work done on Macintosh, Microsoft Windows, UNIX, or proprietary platforms. Of the printers surveyed, 12% do not use the Macintosh platform; the remaining 88% employ that platform in printing production. Of those printers that use the Mac, however, only 38% use the platform exclusively. This indicates that the majority of printers surveyed use a mix of platforms in their production environments. In fact, 50% of the printers surveyed use the PC in production, though only 6% use Windows machines exclusively. Of the printers surveyed, 14% employ the UNIX platform in production work, and 14% use a proprietary system, which in many cases may be a UNIX system in disguise (see Table 4).

The data suggest that the Macintosh operating system is the most prevalently used in printing production; however, the data also suggest that the Windows operating system is commonly used. The implication of this data for educators is that students should be well schooled in both Mac and PC operating systems if they are to be well prepared for work in the printing industry.

- Which page layout software program is most prevalently used in the printing production process? Respondents were asked to indicate the page layout software most often used in the preparation of documents for reproduction. QuarkXPress was the page layout soft-

System	Percentage of Total Work				
	0%	25%	50%	75%	100%
Macintosh	12%	12%	10%	28%	38%
MS Windows	50%	30%	4%	10%	6%
UNIX	86%	10%	4%	0%	0%

Table 4: Approximate Percentage of Production Work Done on Each Platform

ware used most frequently, with 66% of respondents using the software for over 75% of their work. However, only 18% of the respondents indicated that QuarkXPress was used exclusively. The remaining 82% use other page layout software or a mix of packages. Adobe PageMaker was the next most frequently used, with 76% of the printing companies employing the package for at least some work. However, only 6% of the respondents use PageMaker for over 75% of their work.

The survey suggests that Corel Draw, Adobe InDesign, or other packages have yet to make significant inroads into printing production, with 94% of the respondents using none of these packages. The page layout software used in printing production most likely reflects the packages used by advertising and design firms in the preparation of documents (see Table 5).

- Which production jobs are in demand? The printers were asked to project which production positions they would need over the next three years. Prepress job titles were derived from those specified in the Imaging Skills Training Curriculum, published by the Graphic Arts Technical Foundation (Wilson, 1999). These titles were used to assure some validity to the titles because job functions in prepress have changed dramatically over the past few years. Other titles used—"press operator," for example—are well established in the printing industry (see Table 6).

Of those responding, 22% indicated a definite need for preflight technicians, while 40% indicated

Package	Percentage of Total Work				
	0%	25%	50%	75%	100%
QuarkXPress	6%	12%	18%	48%	18%
PageMaker	24%	56%	14%	4%	2%
InDesign	96%	2%	2%	0%	2%
Corel Draw	94%	6%	0%	0%	0%
Other	90%	4%	8%	0%	0%

Table 5: Approximate Percentage of Production Work Done with Each Page-Layout Package

Job Title	Response		
	No	Perhaps	Yes
Preflight Technician	40%	38%	22%
File Repair Technician	78%	18%	4%
Scanner Operator	78%	12%	10%
Desktop Publishing Technician	26%	34%	40%
Output Technician	46%	30%	24%
Film Stripper	54%	18%	28%
Press Operator	6%	18%	76%
Finishing Specialist	16%	30%	54%

Table 6: Projections for Hiring Production-Oriented Personnel over the Next Three Years

no need. The remaining 38% responded that perhaps a need would exist. A very high percentage (78%) of the respondents indicated no need for File Repair Technicians, while the remaining 22% indicated a definite or possible need. Only 22% of the respondents thought they would hire a scanner operator over the next three years, with the remaining 78% stating their current needs for scanning-personnel were being met.

Desktop Publishing Technicians were projected as needed by 74% of the respondents, with 40% of those printers indicating a definite need over the next three years. Fifty-four percent of the respondents indicated either a definite or possible need for Output Technicians. These individuals are defined as those who trap, impose, proof, and plate image elements for the reproduction process. Interestingly, 46% of the printers surveyed still perceive the need for hiring film strippers over the next three years. This response correlates well with the portion of the survey indicating that the majority of printers still use film imaging during some portion of the printing process.

The need for press operators among those surveyed was the position of highest need of any of the production positions. Of the respondents, 94% indicated a potential need over the next three years. Help is also needed in the finishing area, with 84% of the respondents indicating a need for finishing equipment operators. These numbers show a very high demand for production personnel

in the press and finishing areas and a much lighter demand in the pre-press production areas.

6. Which printing management-oriented jobs are in demand? The data suggest that Customer Service Representatives (CSRs), estimators, and salespeople are most in demand, with 80% of respondents forecasting a potential need in estimating and 88% in sales. The need for CSRs was also high, with 86% of the respondents indicating a potential need. The need for entry-level production management personnel was also high, with 64% of respondents indicating a potential need over the next three years. In addition, 38% of respondents indicated a potential need for production supervisors and 45% for quality control personnel.

The data suggest that the need for management personnel is strong. The lesser need for production supervisors may reflect the printing industries move toward total-quality management (TQM) philosophies, which require less “shop floor” supervision (see Table 7).

7. Do printing industry executives perceive a need for college-level degrees specializing in graphic communications? The survey asked respondents to indicate the overall need for a two-year, associate-level college degree specializing in printing production and for the overall need for a four-year baccalaureate degree specializing in printing management. Of those responding, 8% indicated that there was no need for a two-year technical degree

Position	Response		
	No	Perhaps	Yes
CSR	13%	15%	72%
Salesperson	12%	25%	65%
Estimator	20%	40%	40%
Production Management Assistant	36%	44%	20%
Production Supervisor	62%	16%	22%
Quality Control	56%	30%	14%

Table 7: Projections for Hiring Management-Oriented Personnel over the Next Three Years

in printing production, while only 6% indicated no need for the four-year management-oriented degree. The vast majority of respondents, over 90%, perceive some need for these degrees. In fact, 56% indicated a strong or urgent need for associate degree graduates specializing in printing production, while 38% of the respondents indicated a strong or urgent need for graduates with baccalaureate degrees specializing in printing management.

The perceived need for college degrees specializing in graphic communications may be somewhat low possibly because many printing owners and managers do not themselves have college degrees, having moved up through the production ranks (see Table 8).

Conclusion

Because the printing industry is in a constant state of technological flux, data on the current state of the industry are required to make sound curricular decisions for technology-based programs. Too often, curriculum decisions are made based on available equipment or existing faculty skill sets. The purpose of the needs assessment is to gather data that help define what an ideal curriculum should accomplish. It is then possible to seek out solutions for the best ways to meet the needs of students, the business sector, the educational department and institution, as well as the society served.

The data presented in this study reveal the technological state of only a small cross section of the Pennsylvania printing industry. Other means of gathering data must be used to achieve a more complete picture, including literature reviews, personal interviews, and on-site visits. It is important to note that the data presented in this study will have more significance for some educational pro-

Type of Degree	Perceived Level of Need				
	None	Marginal	Needed	Strong	Urgent
B.S.-Management Emphasis	6%	26%	30%	26%	12%
A.A.S.- Production Emphasis	8%	16%	22%	26%	30%

Table 8: Perceived Need for College Degrees in Printing and Publishing Technology

grams than others.

The data presented do suggest a number of interesting implications for the Pennsylvania printing industry and for educational programs preparing workers. Film is still in heavy use, which suggests that it is too early to abandon instruction on topics such as imagesetters, film structure, film variables, film processing chemistry, film assembly, and analog proofing. On the other hand, many printers have made the investment in computer-to-plate technology, and still more will make the switch in the coming months. Their responses suggest that increased emphasis should be placed on such topics as digital trapping, digital imposition, networking, color management, platesetters, and digital proofing. Clearly, process color is pervasive in most printing companies, suggesting that education on the theory and techniques of color reproduction should play an important role in the program curriculum.

While many educators argue about which computer platform is "best," the data presented in this study suggest that the printing industry is using a mix of operating systems, and as responsible educators we should be preparing students for proficiency in both Windows and Macintosh environments, regardless of our alliances. The same goes for page-layout packages. While QuarkXPress may be the most commonly used, Adobe PageMaker is also used for a significant amount of production work. Again, students should be prepared to work with both packages. Better still, instead of teaching "QuarkXPress," educators should stress the generic principles of desktop publishing, helping students to develop the ability to learn new and diverse software.

There appears to be a strong demand for production employees in the Pennsylvania printing industry. The data suggest that the demand for press and finishing equipment operators is particularly acute, and while the demand for pre-press personnel exists, it is much lighter. Management-oriented professionals are also in high demand, especially customer service representatives, sales representatives, and estimators.

Most printing executives appreciate the role graphic communications education plays in keeping the printing industry strong and viable. To this end, the data suggest that the perceived need for college degrees specializing in printing and pub-

lishing technology is high among leaders in the Pennsylvania printing industry. Their perceptions provide some assurance that the image of graphic communications education in Pennsylvania is strong and that graduates have been and will continue to be well received in the workplace.

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**Daniel G.
Wilson, D.I.T.**

Associate Professor

Dr. Wilson is an Associate Professor in the Department of Communication Arts at Pennsylvania College of Technology. He teaches and develops a wide range of graphic communications courses, though his highest level of expertise falls in the areas of offset lithography and color reproduction. Dr. Wilson's academic preparation includes B.S. and M.S. degrees from Northern Illinois University and the D.I.T. degree from the University of Northern Iowa.

Graphic Communication Patents: The International Picture

Harvey Robert Levenson
Graphic Communication Department
California Polytechnic State University, San Luis Obispo

Introduction, Overview, and Purpose of Study

Introduction

The Research and Engineering Council of the Graphic Arts had been compiling and publishing graphic communication patent abstracts since 1961 (Research and Engineering Council of the Graphic Arts Industry, Inc.). In its publication, *Recent Patents of Interest in the Graphic Arts*, the Council published all patents that have been filed in every facet of the graphic communication technology worldwide. What follows is a 30-year content analysis of the patents compiled from 1968 through the first three months of 1997, shortly before the publication of the patent abstracts was terminated. The analysis shows:

1. All of the nations that have filed graphic communication patents, the year they were filed, and the number of patents filed by nation per year.
2. Patents filed by alphabetical subject and the number of patents focusing on that subject.
3. Patents by subject and the number of patents focusing on the subject from greatest number to least number.
4. Relatively active years and relatively inactive years of patents filed by nation.

From this analysis, some telling observations and trends emerge regarding the most active nations in filing graphic communication patents. The study shows what nations to look to for developments in isolated graphic communication technologies. It shows the relationship between the world's economy at any time in the 30-year continuum and patent production, technical trends in graphic communication technology, and where in the world technology is developed to support such trends.

Overview

There were 42 nations that filed graphic communication patents between 1968 and 1997. In all, 22,552 patents were filed with the United States, Germany, and Japan accounting for 19,498 patents or an astounding 86% of the total. This is a clear indication of where the power of inventiveness is and is likely to continue well into the twenty-first century. Of this, the United States was by far the most productive in patent filings, with 12,800 graphic communication patent filings over the 30-year period accounting for 57% of the 22,552 patents filed world-wide. The United Kingdom and Switzerland were the next largest producers of patent filings, with 771 and 686 graphic communication patent filings respectively over the 30-year period. Hence, those countries are not nearly as productive as the United States, Germany, and Japan.

Purpose of the Study

The purpose of this study was to provide insights on the patenting process and international trends on patent filings in the graphic communication industry. Such information can be helpful in graphic arts trends analysis and in making predictions concerning what nations to look to for the development of new graphic communication technology and the nature of such technology.

Literature Review

Intellectual Property and the Patenting Process

The Western world, and particularly the United States, is steeped in policies and laws that encourage entrepreneurs but limit the degree to which they may profit beyond ethical and reasonable bounds in capitalizing on their creativity. Carl Snyder wrote about such controls in 1940.

Often we meet the phrase “outrageous” profits, or “scandalous” monopoly, favorite themes of the reformatory mind. As far back as we process any detailed history, there have been laws against usury, laws to limit prices (therefore profits), laws to curb monopolies, laws against combinations in “restraint of trade.” Why the deep-rooted tendency? As if high profits were not only harmful, but also “wrong”; a species of robbery. And so we find in governments of all ages and in the United States, hundreds of enactments and proposals with this aim. Easy to see that profits can never long be unduly high; that they are naturally self-regulating, and can never for any length of time much exceed the going rate of interest (Snyder, 1940).

Patenting is one of the regulatory controls that provide a balance between inspiring entrepreneurs but limiting monopolization of creative ideas. While the patenting process inspires new ideas that lead to the growth of economics and improvements in quality of life, they are valid for only twenty years in the United States, a relatively short period of time in the general scope of modern civilization. After that time, ideas become part of the public domain.

The evolution of the printing press, from manual to modern presses, displays the product of entrepreneurs stemming from an incentive-inspired patent system. Snyder goes on to note:

...consider a modern printing press, turning out hundreds of thousands printed papers per hour, at a speed almost terrifying to watch. [It is] almost inconceivable that such a substance like paper can be whirled through monstrous rollers with such rapidity and not be torn to shreds. These printing presses are again the product not of the worker but of inventive talent. Compare their output with that of an ancient hand press such as may be found in the museums. It is the “investment” in these machines that makes it possible to sell a modern newspaper [of a numerous number of pages at the price of a few cents] (Snyder, 1940).

The printing press and its components are, indeed, the product of more patents than any other facet of printing technology. However, on an increasing basis in the graphic arts, skills and knowledge have become the only source of sustainable long-term competitive advantage. Intellectual property lies at the center of the modern printing company’s economic success or failure (Thurow, 1997), and protection of intellectual

property, such as patents and copyrights, has taken on a more meaningful role than ever before.

According to Lester Thurow (1997), some major companies, particularly those in the software development business, own nothing of value except knowledge, and so fighting to defend their intellectual property is how they maintain economic viability. Thurow points out that for more than a century the world’s wealthiest human beings were associated with oil. However, since the mid-1990s, and for the first time in history, the world’s wealthiest people are “knowledge workers,” and the nation’s most profitable companies are those with “a lock on some form of knowledge.”

The rising importance of intellectual property can be seen in the earnings gained from the licensing of patented technology. In the past, notes Thurow, companies were willing to share their technology because it did not seem to be the source of their success and could not be sold for much. However, since the late 1990s, new technologies make enforcement of property rights much tougher. People can use high quality scanning technology with optical character recognition to build electronic libraries quickly and easily. In turn, electronic publishers can just as quickly and easily convert that material back into printed form. When anything can be rapidly, cheaply, and privately replicated in low volumes at high levels of quality and then distributed in whatever form the user wants, the means to prevent reproduction of what used to be printed material have disappeared. With that disappearance, says Thurow, comes the end of the copyright system, not just for books but for all information and data systems. A system designed to allow people to browse and borrow books from physical libraries cannot provide the right framework for dealing with the issues raised by the possibilities of downloading a book from an electronic library. If books can be freely downloaded, he suggests, then those selling financial information will also find their databases can be downloaded and resold by lower-cost competitors whose costs are lower because they did not have to incur the costs of creating the databases (Thurow, 1997).

“Copying” is the only way to catch up. Every country that has caught up has done so by copying. The Third World countries know that unless they can acquire the necessary knowledge, they

will never make it to First World status. They cannot afford to buy what they need, even if those who have the knowledge were willing to sell it and they usually are not. So nations have to copy. Countries also differ greatly in their propensities to use their patent systems. Switzerland, for example, issues four and one-half times as many patents per capita as the United States, although the United States is the largest producer of graphic arts patents in the world, followed by Germany, Japan, and the United Kingdom. For a thirty-year period between 1968 and 1997, Switzerland was the fifth-largest graphic arts patent producer in the world (Thurow, 1997).

Thurow contends that free use of knowledge ends up with societies creating too little knowledge. To develop new products and processes, individuals must have a financial incentive to undertake the costs, risks, and efforts of developing new knowledge. The standard incentive is to give inventors a monopoly (patent) on the rights to produce the products that can be created with their knowledge, a right that they can use or sell. Laws on intellectual property rights must be enforceable, or they should not be laws, says Thurow, and the need for the protection of intellectual property has never been greater (Thurow, 1997).

The concept of intellectual property, and the problem of how to protect it, has evolved as partnering has progressed in the way of mergers, joint ventures, and acquisitions in the graphic arts industry. Intellectual property has traditionally been undervalued in this field, but with growing access to a company's knowledge base by outsiders due to increases in partnering, companies are now taking precautions that were previously thought unnecessary. The printing industry has faced a growing number of infringement suits and settlements, and many manufacturers of printing supplies and equipment are now involved in cross-licensing as a way to protect their interests and to prevent lawsuits, either as plaintiffs or defendants.

Patent History

The foundation of American patent law dates back to ancient Greece, and it was the Statute of Monopolies, adopted in England in 1623, that addressed a number of basic patent issues that

remain relevant today. Beginning in medieval times, certain segments of European commerce became centralized and exclusively controlled by various groups. The most notable of these were the early guilds, each of which partially controlled areas of commerce such as leatherworking, glass-making, and the manufacturing of goods. These early "monopolies" were not like the exclusive rights granted for incentive development today; they were basically groups of artisans who had "cornered the market" for the products they developed. Eventually, the right to control various sectors of the market became a royal privilege, granted by the monarch in return for various benefits. Such early "patent" monopolies were not concerned with invention to the extent that they were concerned with commerce. Thus, the concept of "importation patent" became common, where the monarch would grant the privilege to practice a particular art or manufacturing process to a foreigner who brought new technical skills into a country. This was analogous to a licensing procedure that brought needed technology to a nation and, thus, prevented having to reinvent it. The term of a patent or license was almost always for a certain number of years, and the patentee would often be required to train citizens in the new art (Miller & Davis, 1990).

By the time of Queen Elizabeth, the practice of royal patents started to inhibit free competition. This effect was heightened by the gradual transition from a feudal to a mercantile economy. Because the patents were not granted for new inventions, those who really profited from the practice were the monarch and the patentee. In time, the increased influence of the common law courts enabled judges to declare unlawful the most serious abuses of this royal exclusive privilege. However, this initially did not succeed in effectively eliminating the economic monopoly produced by the royal patents. This required legislative action and in 1623 the Statute of Monopolies effectively ended the most serious monopolies, those effecting free trade and competition in staples and commodities (Miller & Davis, 1990).

Starting with the importation patents, it was recognized that the grant of an exclusive privilege to a person with a valuable talent would provide benefits to society if that privilege encouraged the person to practice her or his skill within the state

and encouraged the spread of new techniques. The American Colonists recognized that the offer of an exclusive patent to an individual who invented something new and useful would tend to encourage inventiveness. By the time of the American Revolution, nearly all of the colonies had granted patents. In addition, during the period of the Articles of Confederation, well-established state patent practices developed. At the Constitutional Convention in 1787, a measure was enacted to incorporate as one of the new federal powers the ability to secure, for limited times, patents and copyrights: "The Congress shall have power...to promote the progress of scientific and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries" (Miller & Davis, 1990).

The first patent statute was enacted in 1790. Since that statute there have been only three major revisions of the Patent Act, in 1836, 1952, and 1973. A main reason for so few changes in the Act is that it never has been a politically attractive or major issue. Therefore, considering a rapidly changing society and a relatively stable statute, changes in the patent law have been infrequent and most have come from the courts. Until 1836, there was no administrative body of government that examined the validity of patents.

Since then, however, the Patent Office has been established with the authority to examine patents and determine whether patent applications satisfy the requirements of the statute. The Patent Act in use during 2000 was enacted in 1952 and describes the legal requirements and practical steps of patent application, grant, use, and challenge. It was produced through the statutory and judicial experience of the preceding 150 years (Miller & Davis, 1990).

It is this history and structure that has provided access to patents, thus enabling the United States to become the foremost graphic arts patent producer in the world.

Research Method

The research method used for this study was Content Analysis; a popular method for communications research. Content Analysis is a method of organizing and quantifying qualitative information. Hence, findings are expressed numerically.

A fundamental requirement of Content Analysis is that qualitative information be categorized into units of analysis in such a way that results, appropriate to each category, can be listed and counted.

The following categories were developed for this study:

- Number of graphic arts patents filed over 30 years (1968 through 1997).
- Number of patents filed per year.
- Nation under which patent was filed.
- Number of patents filed per nation.
- Technology represented by each patent.
- Increase in patent filings over the 30-year period.
- Decrease in patent filings over the 30-year period.
- Static patent activity over the 30-year period.
- Years of active patent activity.
- Years of inactive patent activity.

Data under each category are presented as tables. Following the tabulations under each category, descriptive assessments are provided. The assessments are meant to explain the meaning and implications behind the data.

Results

The 30-year span of patent filing shows some interesting trends. For example, the impact of the late 1980s to early 1990s recession shows a decline in patent filings for the major producers of patents worldwide. Additionally, activity in the filings for certain patent categories are congruent with eras related to world industry development. For example, graphic arts patent filings were generally high between 1968 and 1975. This was the era of aerospace cutbacks when thousands of sophisticated aerospace scientists and engineers were let go after the goal to place a person on the moon in July, 1969 was realized. The majority of these highly educated and trained individuals filtered into the private industrial sectors and the printing industry was the beneficiary of many of them. The inventiveness of these individuals, who developed a focus on the needs for the future development of the graphic arts industry, is responsible for the era of prepress photo-optical technology on the cusp of the computerization of the industry in the years spanning 1976 through 1982. It was then that a

large number of patent filings addressed the need to revamp and standardize prepress. It was during these years that technology was advanced in phototypesetting, and electronic scanning for the production of color separations became a mainstay leading to a sharp decline in the use of conventional graphic arts cameras; first of the horizontal type and then of the vertical type. This led into the pre-recession years and the birth of integrated systems and then desktop publishing at around 1983. It then led to the post-recession years of further development of desktop publishing hardware and highly electronic printing presses; first of the conventional type, and then of the short-run, on-demand digital printing systems. A relatively high concentration of patents related to such technologies was filed between the years of 1982 and 1997.

All of the nations that have filed graphic communication patents, the year that they were filed, and the number of patents filed by nation per year appears in Table A.

Observations

The greatest patent filing activity occurs in the areas of high cost centers for technology (hardware) and in the areas of the most expensive disposable commodities used in the printing industry. For example, of the 22,552 patent filings between 1968 and 1997, 7,149 related to printing presses and press components such as cylinders, inkers, fountains, and rollers. This is 32% of all of the filings. Add to this the additional 1,093 filings in the category of non-impact printing and 38 filings for dry offset or waterless printing, and the number of printing-press-related patent filings grow to 8,280 filings or 37% of the total.

Printing presses generally are the most expensive equipment used in printing, and press departments are typically the highest cost center in printing plants. In other words, it is more expensive to do work in the press department than in any other department due to the cost of capital equipment, the cost of labor, and the cost of expensive disposable commodities such as paper and ink.

The next level of greatest patent filing activity is in categories related to disposable commodities used on printing presses. These include printing plates and platemaking, inks and varnishes, and

paper and other substrates. The number of patent filings are quite close in these three areas with only a variation of 246 from 2,320 filings in the Plates and Platemaking category to the 2,074 filings in the Papermaking and Substrates category. There were 2,215 patent filings in the Inks and Varnishes category. These three categories account for 6,609 patent filings or 29% of the 22,552 filings over the 30-year period.

The category of Color Reproduction and Color Measurement Devices has the next highest category of filings with a total of 1,380 patents for the 30-year period, or 6% of the 22,552 filings. The relatively high positioning of this category in the list is attributed to the great emphasis on color reproduction, as opposed to black and white printing, between 1968 and 1997. Inventors responded to growing customer demands for more and better color, and the printing industry need to better control color. Indeed, some industry analysts have said that during the 30-year span of the patents being reviewed, color was the only growing facet of the graphic arts, largely brought on by the popularity of color television.

The category of Scanning has 553 filed patents and could have been included in the Computers and Integrated Systems category because many of the filings relate to the more recent flatbed and rotary drum desktop scanners. However, many of the scanner patents filed also apply to the earlier analog scanners and high-end digital scanners developed in the 1970s and early 1980s. Hence, scanning is kept in a category of its own.

Patent filings related to binding and finishing are on the decline with only 497 filings for this typically capital-intensive, high-cost-center area. The decline is due to the need for relatively few innovations in traditional binding and finishing technology. This is because existing technology such as cutters, folders, stitchers, and trimmers seem to last indefinitely. In addition, the implementation of demographic binding, as well as the on-line integration of binding and finishing into printing presses, has caught on and has made finishing a value added process as part of printing in many instances.

Other categories on the low end of patent filings relate to some declining technologies that are rapidly being removed from printing. Examples

Text continued on page 16

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Argentina												
Australia		4	2	5	3	1	3	2	3	3	1	2
Austria	8	1	1	8		1	6	3	14	2	2	1
Bahamas				1								
Belgium	10	5	8	10	12	8	3	4	6	5	1	1
Brazil			1									
Bulgaria		1										
Canada	11	9	16	14	15	14	8	9	2	5	3	5
China												
Czechoslovakia		2	2	13	8	2	6	3	2	2	2	2
Denmark	2		5	3	2	1	2	2		1		
El Segundo												
Finland	4	4	2	5	4	9	1	4	1		1	1
France	13	14	12	20	13		14	9	4	11	8	3
Germany	102	112	136	143	112	101	90	92	87	72	63	55
Greece			1									
Hungary												
India		1										
Ireland			1		1							
Israel							1	1				
Italy	2	9	6	9	7	4	7	13	8	2		7
Japan	20	51	68	108	124	75	76	72	101	90	81	60
Korea												
Mexico		1	1				1					
Netherlands	14	12	3	6	9	9	5	2	2	6	7	1
New Zealand										1		
Nigeria				1								
Norway	2	1	1		1	2		1			1	1
Poland										1		
Puerto Rico				1				1				
Russia	1			1		2	6	7	4			2
Scotland					1							
South Africa					1							
Spain	1			1					1		1	
Sweden	10	7	15	11	9	4	8	8	10	2	2	7
Switzerland	15	20	16	18	26	13	21	29	18	15	16	8
Taiwan											1	
United Kingdom	36	76	71	74	48	46	32	30	29	16	23	15
United States	1023	1024	1129	1224	944	698	570	555	392	264	236	177
Venezuela												
Wales												
West Indies												
	1274	1354	1497	1676	1340	990	860	847	684	498	449	348

Table A1: Graphic Communication Patents 1968-1979

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Argentina											
Australia	3	1			1	1				1	
Austria	2		1						1		
Bahamas											
Belgium		1		2	1		1	5		1	3
Brazil											
Bulgaria											
Canada	2	2	2	5	2	1	4	2	4	3	4
China											
Czechoslovakia	1		2	1	2	1	1		1	1	
Denmark								2		4	1
El Segundo											
Finland	6	4	2	2	2	4	2	7	2	4	1
France	9	7	4	8	7	6	3	6	3	5	10
Germany	67	46	56	110	110	146	134	136	118	150	120
Greece											
Hungary							1				
India				1							
Ireland											
Israel	1				1			1			1
Italy	5	3	2	8	4	5	8	6	8	1	8
Japan	85	54	46	60	78	87	115	119	110	118	113
Korea										1	1
Mexico											
Netherlands	3	1	4	2		6	2	2	2	11	7
New Zealand								1			
Nigeria											
Norway								1	1		
Poland											
Puerto Rico											
Russia	1				1						
Scotland											
South Africa											
Spain	1		1			1					
Sweden	4		3	8	2	7	3	3	1	1	4
Switzerland	11	10	9	12	18	34	38	36	20	27	25
Taiwan										1	
United Kingdom	13	15	6	10	12	21	12	17	14	23	27
United States	202	138	129	164	189	239	134	194	184	176	246
Venezuela					1						
Wales									1		
West Indies											
	416	282	267	393	431	559	458	538	470	528	571

Table A2: Graphic Communication Patents 1980–1990

	1991	1992	1993	1994	1995	1996	1997*	
Argentina				1				1
Australia	3					2		41
Austria	1	1		1			2	56
Bahamas								1
Belgium	7	3	17	13	19	19	29	194
Brazil							1	2
Bulgaria								1
Canada	3	8	4	5	5	9	6	182
China	1				4	1		6
Czechoslovakia	1							55
Denmark	1	2	1	2	1	2	1	35
El Segundo				1				1
Finland	1	4	1	1	2	17	1	99
France	10	6	9	9	12	18	3	256
Germany	163	179	149	217	204	226	84	3580
Greece								1
Hungary								2
India								2
Ireland								2
Israel	1	11	4	15	4	12	5	58
Italy	4	8	14	12	3	11	6	190
Japan	146	127	188	206	146	236	158	3118
Korea			1		1	5	3	12
Mexico								3
Netherlands	3	4	3	6	5	19		156
New Zealand								2
Nigeria								1
Norway					1	1		14
Poland								1
Puerto Rico								2
Russia			2					27
Scotland								1
South Africa								1
Spain	2			2				11
Sweden	6	4	3	2	5	8	1	158
Switzerland	48	53	19	29	41	24	17	686
Taiwan		1	3	5	2	3	2	18
United Kingdom	18	14	9	24	12	19	9	771
United States	299	333	378	442	313	515	289	12800
Venezuela								1
Wales								1
West Indies		2						2
	718	760	805	993	780	1147	617	22552
*3 months in 1997								

Table A3: Graphic Communication Patents 1991–1997

include traditional art and copy preparation, typesetting as a specialized skill area in the production of printing, traditional image assembly commonly referred to as stripping, and graphic arts photography on process cameras and on large, high-end, scanners. Yet, other categories on the low end of patent filings do not represent declining technologies, but very focused and specific technologies having specialized applications and include categories such as toners, lasers, holography, optical character recognition, and so on.

A surprising observation is that the least patent filing activity appears in the categories of Environment that includes air quality, disposals, recycling, and safety, and in the category of Quality Control. These are relatively important areas and a logical explanation is that the majority of patent filings in these categories result from inventiveness in industries other than the graphic arts.

Finally, while there have been ups and downs in patent filings in many of the categories listed, the general 30-year trend between 1968 and 1997 in new technology developments in the graphic arts are (see Tables B and C):

Increases in Patent Filings

Color Reproduction and Color Measurement
Computers and Integrated Systems including:

Digital and Electronic Imaging
Imagesetting
Plotters

Dry Offset (Waterless Printing)

Non-Impact Printing including:

Electrostatic
Electrophotographic
Ink Jet

Inks and Varnishes

Lasers

Papermaking and Substrates

Press and Press Components including:

Cylinders
Inkers
Fountains
Rollers

Proofing

Scanning

Toners

Decreases in Patent Filings

Art and Copy Preparation

Binding and Finishing

Blankets
Cameras and Photography
Chemicals
Fountain Solutions
Holography
Image Assembly (Stripping)
Optics
Optical Character Recognition
Plates and Plate Making
Screening
Typesetting

Relatively Static Activity in Patent Filings

Environment including

Air Quality
Disposals
Recycling
Safety

Materials Handling

Quality Control

Table D shows the number of patents produced by each nation from the highest number of filings to the lowest number of filings. Table E shows the relatively active and inactive years of patent filings from 1968 to 1997.

Observations

The degree of patent filing activity or inactivity is very much related to national and world conditions such as the economy, social conditions, wars, political climate, and government ideology. Nations that have embraced the ideologies of capitalism and free enterprise are consistently the most stable and largest producers of patent filings. However, even these nations have experienced various peaks and valleys in filings relative to the overall number of filings between 1968 and 1997.

On the top of the list of the most stable and largest producers of graphic arts patents are the United States, Germany, Japan, the United Kingdom, and Switzerland. On the bottom of the list are nations that have struggled through harsh economic conditions over the 30-year period, and national priorities had to be on issues of providing food, clothing, and basic shelter for vast populations of people as opposed to advancing technology in the graphic arts. However, even in these cases there were one or two instances of patent fil-

Text continued on page 18

Patents filed by alphabetical category, by number of patents focusing on each category, and by general activity trend (- = decreasing, + = increasing, S = status quo).

Category	No. of Filings	Activity
Art and Copy Preparation	210	-
Binding and Finishing	497	-
Blankets	215	-
Cameras and Photography	172	-
Chemicals	84	-
Color Reproduction and Color Measurement	1380	+
Computers and Integrated Systems including:	1182	+
Digital and Electronic Imaging		
Imagesetting		
Plotters		
Dry Offset (Waterless Printing)	38	+
Non-Impact Printing including:	1093	+
Electrostatic		
Electrophotographic		
Ink Jet		
Environment including	12	S
Air Quality		
Disposals		
Recycling		
Safety		
Fountain Solutions	43	-
Holography	46	-
Image Assembly (Stripping)	46	-
Inks and Varnishes	2215	+
Lasers	132	+
Materials Handling	13	S
Optics	174	-
Optical Character Recognition	13	-
Papermaking and Substrates	2074	+
Plates and Plate Making	2320	-
Press and Press Components including:	7149	+
Cylinders		
Inkers		
Fountains		
Rollers		
Proofing	290	+
Quality Control	5	S
Scanning	553	+
Screening	488	-
Toners	150	+
Typesetting	54	-

Table B: Patent Categories and Number Filed (Alphabetical)

Patents by category and the number of patents focusing on each category from greatest number to least number.

Patent Category	No. of Filings
Press and Press Components including:	7149
Cylinders	
Inkers	
Fountains	
Rollers	
Plates and Plate Making	2320
Inks and Varnishes	2215
Papermaking and Substrates	2074
Color Reproduction and Color Measurement	1380
Computers and Integrated Systems including:	1182
Digital and Electronic Imaging	
Imagesetting	
Plotters	
Non-Impact Printing including:	1093
Electrostatic	
Electrophotographic	
Ink Jet	
Scanning	553
Binding and Finishing	497
Screening	488
Proofing	290
Blankets	215
Art and Copy Preparation	210
Optics	174
Cameras and Photography	172
Toners	150
Lasers	132
Chemicals	84
Typesetting	54
Holography	46
Image Assembly (Stripping)	46
Fountain Solutions	43
Dry Offset (Waterless Printing)	38
Materials Handling	13
Optical Character Recognition	13
Environment including:	12
Air Quality	
Disposals	
Recycling	
Safety	
Quality Control	5

Table C: Patents by Category and the Number Filed

Nation	No. of Filings
United States	12800
Germany	3580
Japan	3118
United Kingdom	771
Switzerland	686
France	256
Belgium	194
Italy	190
Canada	182
Sweden	158
Netherlands	156
Finland	99
Israel	58
Austria	56
Czechoslovakia	55
Australia	41
Denmark	35
Russia	27
Taiwan	18
Norway	14
Korea	12
Spain	11
China	6
Mexico	3
Brazil	2
Hungary	2
India	2
Ireland	2
New Zealand	2
Puerto Rico	2
West Indies	2
Argentina	1
Bahamas	1
Bulgaria	1
El Segundo	1
Greece	1
Nigeria	1
Poland	1
Scotland	1
South Africa	1
Venezuela	1
Wales	1

Table D: Nations by Number of Patents Filings

Nation	Active Years	Inactive Years
Australia	1968 - 1980	1981 - 1987
Austria	1968 - 1980	1981 - 1997
Belgium	1968 - 1977 1987 - 1997	1978 - 1986
Canada	1968 - 1979 1986 - 1997	1982 - 1985
Czechoslovakia	1969 - 1979	1980 - 1997
Denmark	1968 - 1975 1987 - 1997	1976 - 1986
Finland	1968 - 1975 1980 - 1997	1976 - 1979
France	1968 - 1978 1983 - 1997	1979 - 1982
Germany	1968 - 1976 1983 - 1997	1977 - 1982
Israel	1992 - 1997	1968 - 1991
Italy	1968 - 1976 1983 - 1997	1977 - 1982
Japan	1986 - 1997	1968 - 1985
Netherlands	1968 - 1978 1989 - 1996	1979 - 1988
Norway	1968 - 1973	1974 - 1997
Russia	1973 - 1976	1968 - 1972 1977 - 1997
Sweden	1968 - 1976 1982 - 1987 1990 - 1997	1977 - 1981 1988 - 1989
Switzerland	1968 - 1978 1984 - 1997	1979 - 1983
Taiwan	1993 - 1997	1968 - 1996
United Kingdom	1968 - 1978 1985 - 1997	1979 - 1984
United States	1968 - 1978 1990 - 1997	1979 - 1989
Overall	1968 - 1976 1985 - 1997 1985 - 1997	1977 - 1984

Low Activity Nations

Low Activity refers to nations that are not typically patent producers but produced a few over the years.

Argentina
Bahamas
Brazil
Bulgaria
China
El Segundo
Greece
Hungary
India
Ireland
Korea
Mexico
New Zealand
Nigeria
Poland
Puerto Rico
Scotland
South Africa
Spain
Venezuela
Wales
West Indies

Table E: Graphic Communication Patents: Relatively Active and Relatively Inactive Years (Relative to Number of Overall Patents Produced by Nation)

ings related to printing for each of these nations which include, among others, Mexico, India, West Indies, Bulgaria, and Nigeria. Yet, other nations in the mid-range or bottom rungs of graphic arts patent filings were not necessarily impoverished or socially deprived nations. They were nations perfectly capable of promoting technological innovation but did not place as high a value on patent filings and technology as they did on the arts and humanities or on facets of life that improve the human condition in ways quite different than technology. These are primarily European nations including France, Italy, Spain, and Greece.

Yet, still other nations could be considered relatively productive in patent filings based on population size. Hence, many relatively small nations have contributed rather important technology to the graphic arts even though the volume of patent filings has been considerably smaller than the large producers of filings. Some examples are Belgium, Canada, Sweden, The Netherlands, Finland, Ireland, Austria, Czechoslovakia, and Australia. If some of these nations had the population and industrial base of the larger patent producing nations, it is likely that the patent filings would be substantially greater for these nations.

Conclusions

While this research spans graphic communication patent development from 1968 through 1997, by the year 2000 patents were becoming increasingly sought after as the need for hardware and software change increased. Patents for intellectual property have increased substantially and have raised questions concerning whether such protections are in the best interest of commerce and consumer service. For example, patent restrictions on new technologies may inhibit start-up companies, particularly smaller ones, due to uncertainties concerning infringement violations and the cost of exploring violation possibilities. Extensive patent research requires the services of attorneys and other specialists, and this could be cost prohibitive. Consumers may suffer because many digital graphic communication technologies, which begin as industrial products, now rapidly become consumer commodities. Some believe that patent restrictions inhibit the diversity of such products available to the public and keep prices higher than

would be the case in a more competitive market.

However, while patents continue to be enforced, those with novel ideas about graphic communication technology had better act rapidly in securing protection because someone else is probably working on the same idea. This particularly relates to digital technology, e-commerce, Internet, and World Wide Web products and applications. The period from conception to market is getting shorter, and financially successful graphic arts patented technologies will be those that relate to immediate needs of printers, publishers, and consumers—not distant needs, as is traditionally the case in new product development. It is likely that such patents will, on an increasing basis, come from corporations more than from individual private inventors and entrepreneurs. Additionally, major graphic arts patent activity will continue coming from the world's industrialized nations with the United States, Germany, and Japan holding their positions as the largest contributors of graphic arts patents. The Research and Engineering Council quarterly publication on graphic communication patents was an excellent guide for keeping abreast of current inventors, inventions, and where new technologies are being developed (Research and Engineering Council of the Graphic Arts Industry, Inc.).

The future holds promise of continued patent development for graphic arts products serving broad needs and having the potential to serve commercial and consumer commodity markets. For example, patent activity is expected to increase for technologies that reduce the waste of high-cost disposable commodities such as paper, and also for technologies which increase production speeds and product delivery of printed items to the end user. The Graphic Arts Technical Foundation's annual InterTech Technology Awards also provide examples of where and for what purpose patented technologies are being developed in the graphic arts profession (Graphic Arts Technical Foundation). Increases in patent filings are expected to continue in technologies related to color control and manipulation, computers, digital and electronic imaging, new variations of lithography such as waterless lithography, non-impact printing devices and supplies, and proofing.

Patenting of software has grown, but questions are being raised about whether software patents

are good for business. Some believe that for major software products they are, but the patent life for software should be restricted to a few years. To allow a diversity of companies and new ideas to flourish in serving market demands, others believe that patents should not be provided for software, and developers should rely on present copyright laws for protection (Widenius, 1998).

Patent suits have been heightened in what has become a multi-billion-dollar battle for e-commerce domination stemming from the practice of granting patent rights not just to devices and other tangible inventions, but also to Internet business models and methods of doing business. One example of the type of patent infringement cases that are expected to increase in the graphic arts field is Amazon.com vs. BarnesandNoble.com in which Amazon.com has sued Barnes and Noble for infringing on its patented click-on ordering technology (Widenius, 1998).

Because of the broadening of what may be patented, patent license revenues jumped from \$15 billion in 1990 to well over \$100 billion by 2000. For example, Dell Home Systems Co.'s build-to-order desktop computer system has resulted in the highest margins and the lowest manufacturing and inventory costs in the industry in the late 1990s with a cash-conversion cycle of approximately eight days. Dell has secured patents on its build-to-order direct sales model (Kline & Kevin, 2000).

The huge success and potential for enormous growth of Internet business approaches and applications have increased patent activity by companies wanting to dominate certain markets. However, it has also raised questions about whether one company should have exclusive rights to capture markets in a tens-of-billions-of-dollars online sales industry that has promise of reaching hundreds of billions of dollars in the early part of the twenty-first century.

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**Harvey Robert
Levenson, Ph.D.**

Professor

Dr. Harvey Robert Levenson is a Professor and Department Head of Graphic Communication at California Polytechnic State University in San Luis Obispo, CA. His specialties are printing, technology, communication, and media. Dr. Levenson holds four degrees, including a Ph.D. in Rhetoric and Communication from the University of Pittsburgh, an M.S. degree in Printing Management from South Dakota State University, a B.S. degree in Printing from the Rochester Institute of Technology, and an A.A.S. degree in Graphic Arts and Advertising Technology from New York City Community College.

Dot Reproduction Analyses on CTP Plates

Yung-Cheng Hsieh

Department of Graphic Arts

National Taiwan College of Arts

Introduction

Hird (1995) indicated that the printing industry is one of the largest service organizations in the world. It is a growth industry, meaning it manufactures more products using more advanced technologies one year than it did the previous year. The industry is constantly developing more sophisticated methods to meet the needs of the growing population. It has invented numerous significant breakthroughs in technology. One of the breakthroughs is the innovation of Computer-to-Plate (CTP) systems in the prepress stage. CTP has been a printing industry buzzword since DRUPA 1995, at which approximately 30 different CTP solutions were exhibited, causing a great deal of interest and speculation.

Statement of the Problem

Computer-to-plate (CTP) has progressed significantly since the DRUPA exhibition. According to Andrew Tribute (1999) at Seybold Publications, a limited number of CTP devices were in use in 1995, probably less than 100 units around the world. Mr. Tribute also indicated that the printing industry currently has nearly 2000 CTP units in use worldwide. Romano and Cary (1998) explained that most users indicated that the benefits of CTP come in two primary areas: faster time from file to plate and faster makeready. Overall, users are finding more peripheral benefits for CTP in terms of turnaround, digital workflow, and the handling of shorter runs. There is no doubt that CTP technology has become an important component of a standard graphic arts workflow and will continue to remain one of the hottest topics in the printing industry. Thus, the open question is "which CTP plate material and system is best for you?" or "which CTP plate material and system provides high quality, great consistency, and the lowest achievable price?"

Need for the Study

Southworth (1996) stated that when choosing a CTP unit, three things to consider are dot size variation, resolution, and image line width. Among them, dot size variation is the most critical factor, affecting color balance, gray balance, and clean color. In addition, the results of many studies agree that one of the most important factors of choosing a CTP unit is its process consistency, and dot size variation is the key to the process consistency. Without a consistent CTP process, a printer cannot achieve the desired print output characteristics. Therefore, there is a great need to study the process consistency and capability of various types of CTP plates by evaluating their dot area variation. According to the *General Requirements for Applications in Commercial Offset Lithography Version 2.0* (GCA, 1998), there are three crucial input variables which must be controlled in order for offset printers to achieve optimum output print characteristics: solid ink density (SID), print contrast (PC), and total dot gain (DG). These three characteristics are the most commonly measured values associated with dot area variation for lithographic printers.

Purposes of the Study

The main purposes of this study were twofold: 1) to explore the differences in dot reproduction for the widely used CTP and conventional PS (pre-sensitized) plates in Taiwan, and 2) to compare the dot reproduction consistency of CTP plates with that of conventional PS plates in terms of solid ink density, print contrast, and total dot gain. The CTP plates used in this experiment were silver-halide, photopolymer, and thermal aluminum-based plates. One widely used pre-sensitized plate was also studied for the purpose of comparing its performance with the CTP plates.

Limitations of the Study

The following limitations are important to interpret the conclusions of this study:

1. Each plate reading entered into the statistical software package was a mean value of five measurements from the spectrodensitometer.
2. All dot area values on the plates were measured by the Murray-Davies equation and the measuring procedures were determined based on the recommendations of the densitometer manufacturer.
3. The material, production, and labor costs for the plates were not studied. The main interest of the study was on the dot-reproduction quality and consistency for the plates.

Review of Related Literature

Generally speaking, computer-to-plate technology (CTP) is a digitized plate-imaging process. Customers provide all editorial and advertising content in digital form to printers who, in turn, electronically produce printing plates, eliminating all the traditional intermediate film-preparation stages (Adams II and Romano, 1999).

In a lithographic printing system, computer-to-plate (CTP) is generally defined as exposing an offset printing plate directly from an electronic master. Indeed, a complete CTP system would include the following digital procedures:

1. using a software application to compose several single-page layouts,
2. utilizing an imposition software to accomplish the overall job layout based on the desired finish size and binding requirements, and
3. employing a platesetter to output the plates by exposing dots directly onto the plates using a laser light source, and the plates are developed and ready for printing.

CTP vs. Conventional Methods

Compared with traditional plate-making methods, the production time using computer-to-plate technology is much faster. All documents and files are electronically processed in CTP systems, eliminating several time consuming and labor-intensive steps in the process. By eliminating film, printers

get first-generation printing plates with better resolution and fewer possibilities for plate errors.

CTP systems and technology continue to remain one of the hottest topics in the printing industry over the past few years. One advantage of using CTP is that it eliminates the prepress steps of exposing and developing films, stripping films, and platemaking; most of which are manual tasks. Going filmless eliminates the need to dispose of used photographic chemicals and silver-based films, as well as the cost of new supplies, and the equipment and maintenance of that equipment. The changes attributable to just the CTP investment were (GCA, November, 1998):

- Elimination of imagesetting
- Elimination of film processing
- Addition of soft proofing
- Transition to digital imposition proofing

Types of CTP Plate Materials Studied

The major CTP plate materials in Taiwan's printing industry include the following:

Silver halide. Silver-halide plates are very light sensitive and easy to use but have suffered from lower run lengths compared to polymer and thermal plates. They are the least expensive plates at present but do require red safelight handling and require special chemical disposal.

Photopolymer. The early Anitec-Horsell Electroplate was an extension of the high-speed photopolymer plate shown in 1990 by Cookson Graphics. Hoechst-Celanese introduced the N90 high-speed, dye-sensitized photopolymer plate in 1990. This plate is coated with a dye-sensitized photopolymer and requires relatively little light energy, such as an argon-ion laser (488nm). Photopolymer plate requires red safelight handling.

Thermal. Thermal plates are true digital plates. Once imaged, the dot size conforms to the size of the laser's imaging spot, and it doesn't change if the plate is processed. They can hold dot structures; they require no chemical processing and therefore are environmentally friendly, they can be handled in either yellow safelight or controlled-daylight conditions; and they have the same handling characteristics as conventional pre-sensitized plates. As their name implies, thermal plates are imaged by heat, rather than by light. The thermal

plate needs higher laser energy to create images than the energy to be used in conventional plates. Thermal plates cannot be overexposed or underexposed (Adams II & Romano, 1999).

CTP Product and Marketing

Studies show that the worldwide plate business is a \$2+ billion industry (December 1997), and by the year 2000 it might reach \$3 billion, with up to 20% of that figure projected to be computer-to-plate metal plates, depending on acceptance of the technology. Some analysts predict that plate use will grow 5% each year into the next century, with CTP and waterless printing causing much of that growth (Adams II and Romano, 1999). Computer-to-plate advanced significantly in 2000 and is projected to do the same in 2001 and beyond, especially as the increasing number of systems drives up availability and quality and decreases costs. In 1998, platesetter costs are already decreasing, especially with smaller systems entering the market. There has been a definable move from 8-up to 4-up systems, bringing the price from \$400,000 to under \$150,000, and 8-up systems are dropping below the \$400,000 level (Romano, 1998). There were about 2,400 platesetters installed worldwide at the end of 1998, about 40% of which were in the U.S., reports Derek Wyse, a principal of the market research firm Vantage Strategic Marketing in the United Kingdom. The number of CTP installations grew about 40% in 1997. While most are in the publication market, the number of installations in the commercial, packaging, and newspaper markets are gaining ground. Based on interviews with its CTP

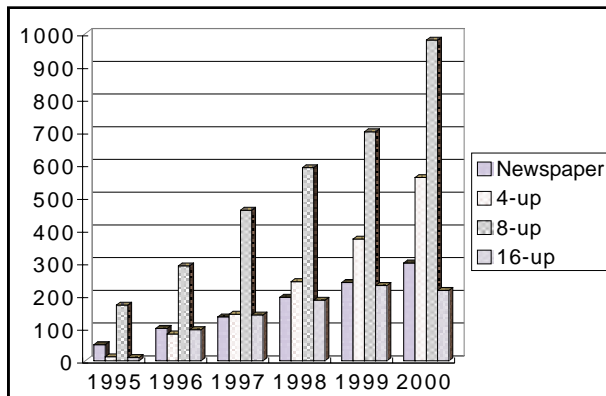


Figure 1: The Number of CTP Platesetters Installed Worldwide (Adams II and Romano, 1999)

plate customers, PDI (Printing Developments, Inc.) estimates that the transition from conventional to full digital workflow takes anywhere from two months to two years, and has less to do with hardware than with a customer's familiarity with digital workflow, employee training, and available resources (Sharples, 1999).

Figure 1 classifies the number of CTP systems installed worldwide and its prediction by the plate output size. As shown in Figure 1, the number of each type of 4-up, 8-up, 16-up, VLF (Very Large Format), and Newspaper has steady growth and it is predicted to be increased every year. In addition, Figure 2 categorizes the current (up to the year of 2000) platesetter installed worldwide by the plate output size. Figure 3 sorts the current (up to the year of 2000) CTP marketing based on the different regions. As shown in Figure 3, 45% of the CTP systems have been installed in the North American region, followed by Europe (38%). Japan and other areas in the world have occupied only 17%.

Methodology

This study was experimental research in nature and was intended to investigate the differences of dot-reproduction quality among three major CTP plates and one conventional presensitized (PS) plate in the industry. The plate materials for the experiment were silver halide plate, photopolymer plate, thermal plate, and PS plate. A standard digital test form and control bar was designed for the three CTP plates, and a film generalized from the digital test form was prepared for exposing the PS plate. Forty plates for each of the three CTP and

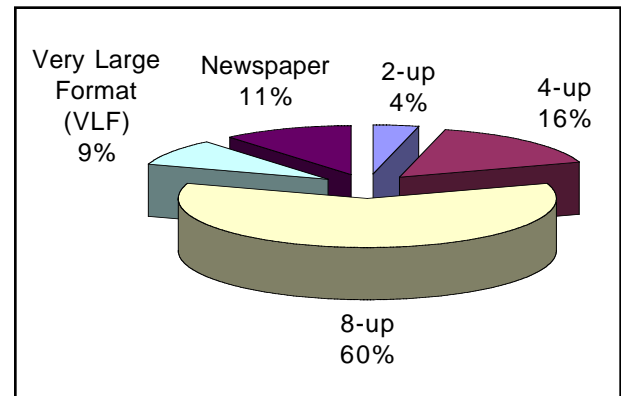


Figure 2: Current CTP System Marketing Categorized by Plate Output Size (Agfa, 2000)

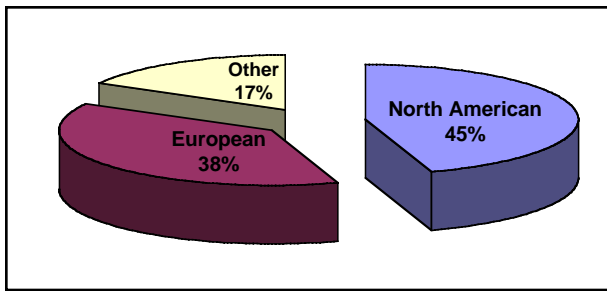


Figure 3: CTP System Marketing Categorized by Regions (Agfa, 2000)

PS plates were made. Thus, a total of 160 plates were produced and they were measured by a plate-reading spectrodensitometer (X-Rite 528). The analyses of dot-reproduction consistency based on the solid ink density, dot gain/loss size, and print contrast were determined statistically. The study also investigated the differences in dot gain percentage ratio among the plates.

Variables

The dependent variables of the study were the solid ink density, dot gain, and print contrast for the CTP and PS plates. The data was obtained from the spectrodensitometry readings of the dot gain percentage (DG), solid ink density (SID), and print contrast (PC). The independent variables were the types of plates, including silver halide, photopolymer, thermal, and PS. The controlled variables included a standard digital test form, spectrodensitometer, room temperature and relative humidity for each platemaking operation, and operator for each platemaking process. It should be noted that the platemaking operational procedures were standardized based on the manufacturer's recommendations during the experiment for each platesetter. In addition, the imagesetter to output the film for making the PS plates was linearized and not applied any compensation curves to the test form. The correct amount of time to expose the PS plates was determined by a UGRA Plate Control Wedge. Table 1 exhibits the plate output conditions and equipment for this experiment.

Measuring Procedures

After collecting all 160 plates (4x40), an X-Rite 528 spectrodensitometer was used to measure the solid ink density (SID), dot areas (DA) on the

Plate Type	Environmental Condition	Output Devices
Conventional PS	Room temperature, Relative Humidity: 45%~55% Room light	PS-32HBB-2 plate explorer, Fuji PS800ES platesetter, Fuji DU800 drier, Exposure time: 30 seconds, Developing time: 40 seconds Drying time: 40 seconds at 85_
Silver halide (AgX) CTP	Temperature: 25_ , Relative Humidity: 40%~50% Dark room (red safelight)	Agfa Galileo / Platemanager CTP platesetter, Developing temperature: 22_
Photopolymer CTP	Temperature: 25_ , Relative Humidity: 40%~50% Dark room (red safelight)	Cymbolic Sciences PlateJet8 Platesetter, Fuji LP-850P developer, Developing temperature: 30_
Thermal CTP	Temperature: 25_ , Relative Humidity: 45%~55% Room (yellow) light	Creo/Trandsetter 3244 CTP Platesetter, Kodak Quartz CTP Developer Pre-heat: 140_ , Developing temperature: 25_

Table 1: The Plate Output Conditions and Equipment of the Experiment

25%, 50%, and 75% tints, as well as print contrast (PC). Each specific area on the plates was measured five times for the purpose of reducing measuring error. Thus, the following analyses were made based on the average of the five readings for each measured attribute.

Results

This section reports the results obtained through analyses of the data obtained from the experiment. The software package employed to analyze the data were SPSS 10.0 and Minitab 12.0.

Descriptive Statistics

Table 2 shows that descriptive statistics for all the dependent variables. The following are divided into five parts to explain the descriptive statistics

	Plate Type	n	Min.	Max.	Mean	Std. Dev.
Solid Ink Density	PS	40	.895	.980	.9150	.0124
	Sliver Halide	40	.610	.750	.7178	.0231
	Photopolymer	40	.898	.940	.9145	.0100
	Thermal	40	.860	.910	.8958	.0108
75% Dot Gain/Loss	PS	40	5.740	7.120	6.4610	.3397
	Sliver Halide	40	1.000	10.800	4.9400	3.0450
	Photopolymer	40	7.860	12.480	11.6605	.8931
	Thermal	40	.100	2.300	.7700	.4542
50% Dot Gain/Loss	PS	40	7.100	9.840	8.8705	.5472
	Sliver Halide	40	.800	9.600	4.4025	2.4363
	Photopolymer	40	10.640	14.120	13.3370	.6170
	Thermal	40	.000	2.000	.6050	.3803
25% Dot Gain/Loss	PS	40	2.580	5.720	3.9150	.6706
	Sliver Halide	40	.600	4.400	2.5255	1.1411
	Photopolymer	40	5.320	8.020	7.2695	.5430
	Thermal	40	.100	1.900	.4550	.4188
Print Contrast %	PS	40	30.220	31.440	30.8255	.2963
	Sliver Halide	40	23.800	31.200	27.5350	1.4318
	Photopolymer	40	19.280	21.420	20.4750	.4455
	Thermal	40	25.600	28.000	27.0350	.5582

Table 2: Descriptive Statistics

for the dependent variables:

Solid ink density. Table 2 indicates that mean solid ink density (SID) of the PS and photopolymer plates are very close (.915, .914), followed by the thermal (.8958) and silver halide plate (0.718).

Dot gain percentage at 75% tint. Generally speaking, a small percentage of dot gain/loss is desirable for printers. For the mean dot gain percentage at 75% tint, the thermal plate has the least amount of dot gain (.77%), followed by the silver halide (4.94%) and PS (6.46%). The photopolymer plates yielded the greatest amount of dot gain/loss (11.66%).

Dot gain percentage at 50% tint. For the mean dot gain percentage at 50% tint, the thermal plate has the least amount of dot gain (.61%), followed by the silver halide (4.40%) and PS (8.87%). Again, the photopolymer plates yielded the greatest amount of dot gain/loss (13.34%).

Dot gain percentage at 25% tint. For the mean dot gain percentage at 25% tint, the thermal plate has the least amount of dot gain (.46%), followed by silver halide (2.53%) and PS plate (3.92%). Again, the photopolymer plates delivered the greatest amount of dot gain/loss (7.27%).

Even though the silver halide plate produced the smallest amount of dot gain in all three tonal values, its dot gain dispersion is the largest among the four plates in all three tonal values. In other words, the silver halide plate is less consistent in dot gain size than the other two CTP plates.

Print contrast. Print contrast is an increasingly popular process control parameter because it is a value that printers wish to maximize (Stanton & Hutton, 1999). Indeed, it represents the tonal range of shadows. It is computed as below:

$$\left[\frac{(D_{SID} - D_{75})}{D_{SID}} \right] \times 100\%$$

where D_{SID} is the density of solid, and D_{75} is the density of the 75% tint.

According to Table 2, the conventional PS plate has the greatest amount of print contrast (30.83%), followed by the silver halide (27.54%) and thermal (27.04%). The photopolymer plates produced the least amount of print contrast (20.48%).

Source	DF	SS	MS	F	P
Factor	3	1.000246	0.366749	1618.56	0.000*
Error	156	0.035348	0.000227		
Total	159	1.135594			

Individual 95% CIs For Mean					
Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps_sid	40	0.91503	0.01241		(*)
agx_sid	40	0.71775	0.02315	(*)	
pp_sid	40	0.91448	0.00995		(*)
tml_sid	40	0.89575	0.01083		(*)
Pooled StDev = 0.01505				0.720	0.780 0.840 0.900

* significant at $\alpha = 0.05$

Table 3: Analysis of Variance of the Solid Ink Sensitivity for the Plates

Major Findings

The differences in the observed attributes among the CTP plates and PS plate via analysis of variance (ANOVA) of the data is explored in this section.

Solid ink density (SID). Table 3 displays the ANOVA table of the solid ink density for the four plates. It shows that there is a significant difference in mean SID among the four types of plates ($p < .05$). Figure 4 exhibits the boxplot of the solid ink density for the plates. It implies that the silver halide (AgX) plate has the poorest performance on solid ink density in both mean value (indicated by the solid circles) and dispersion (indicated by the height of the boxes, Q3-Q1).

Dot gain percentage at 75% tint (75 DG). Table 4 displays the ANOVA table of the dot gain percentage at 75% tint for the plates. It shows that there is a significant difference in mean dot gain percentage at 75% tint among the four types of plates ($p < .05$). Figure 5 exhibits the boxplot of

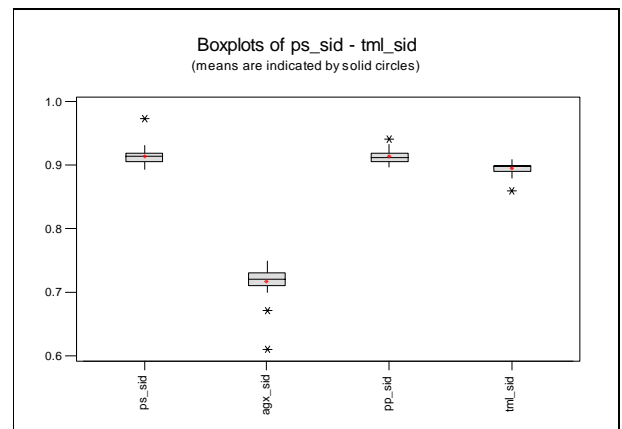


Figure 4: Boxplot of the Solid Ink Density for the Plates

Source	DF	SS	MS	F	P
Factor	3	2428.93	809.64	311.66	0.000*
Error	156	405.27	2.60		
Total	159	2834.20			

Individual 95% CIs For Mean					
Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps_75dg	40	6.461	0.340	(*-)	
agx_75dg	40	4.940	3.045	(*-)	
pp_75dg	40	11.660	0.893	(*-)	
tml_75dg	40	0.770	0.454	(*-)	
Pooled StDev =		1.612		3.5	7.0 10.5

* significant at $\alpha = 0.05$

Table 4: Analysis of Variance of the Dot Gain Percentage at 75% Tint for the Plates

the dot gain percentage at 75% tint for the four plates. It indicates that the thermal plate has the least mean dot gain percentage at 75% tint, and its dot gain variation. The dot gain variation of the silver halide plate is the greatest among the four plates. The photopolymer plate yielded the greatest amount of dot gain size at 75% tint.

Dot gain percentage at 50% tint (50 DG). Table 5 displays the ANOVA table of the dot gain percentage at 50% tint for the plates. It shows that there is a significant difference in mean dot gain percentage at 50% tint among the four types of plates ($p < .05$). Figure 6 exhibits the boxplot of the dot gain percentage at 50% tint for the four plates. It reveals that the thermal plate has the least mean dot gain percentage at 50% tint, as well as its dot gain variation (the height of the box). The dot gain variation of the silver halide plate is the greatest among the four plates. The photopolymer plate yielded the greatest amount of dot gain size at 50% tint.

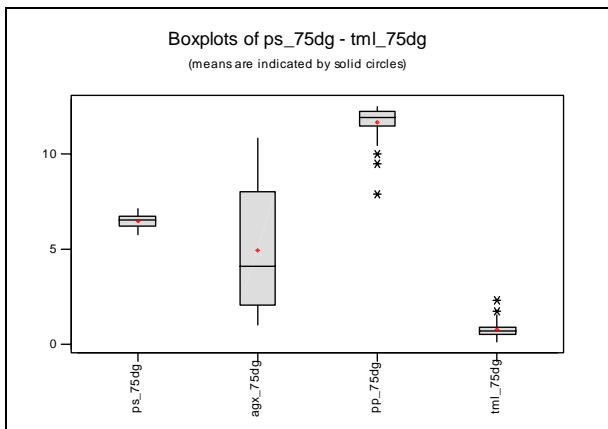


Figure 5: Boxplot of the Dot Gain Percentage at 75% Tint for the Plates

Source	DF	SS	MS	F	P
Factor	3	3645.81	1215.27	719.06	0.000*
Error	156	263.65	1.69		
Total	159	3909.46			

Individual 95% CIs For Mean					
Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps_50dg	40	8.870	0.547	(*)	
agx_50dg	40	4.403	2.436	(*)	
pp_50dg	40	13.337	0.617	(*)	
tml_50dg	40	0.605	0.380	(*-)	
Pooled StDev =		1.300		4.0	8.0 12.0

* significant at $\alpha = 0.05$

Table 5: Analysis of Variance of the Dot Gain Percentage at 50% Tint for the Plates

Dot gain percentage at 25% tint (25 DG). Table 6 depicts the ANOVA table of the dot gain percentage at 25% tint for the plates. It shows that there is a significant difference in mean dot gain percentage at 25% tint among the four types of plates ($p < .05$). Figure 7 exhibits the boxplot of the dot gain percentage at 25% tint for the plates. It indicates that the thermal plate has the least mean dot gain percentage at 25% tint, as well as its dot gain variation (the height of the box). The dot gain variation of the silver halide plate is the greatest among the four plates. The photopolymer plate yielded the greatest amount of dot gain size at 25% tint.

Print contrast (PC). Table 7 illustrates the ANOVA table of the print contrast for the plates. It demonstrates that there is a significant difference in mean print contrast among the four types of plates ($p < .05$). Figure 8 presents the boxplot of the print contrast for the four plates. It shows that the PS plate has the best performance on print

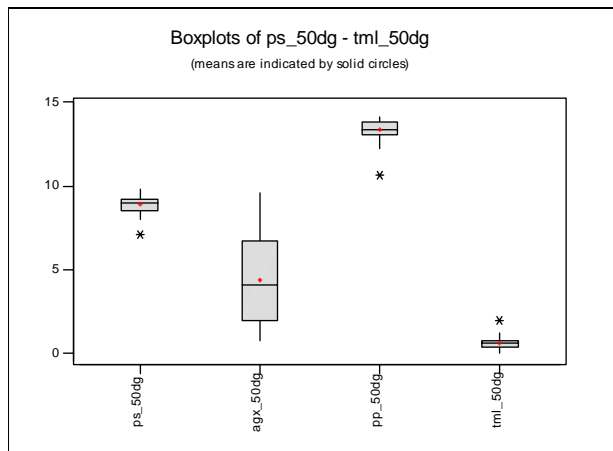


Figure 6: Boxplot of the Dot Gain Percentage at 50% Tint for the Plates

Source	DF	SS	MS	F	P
Factor	3	983.849	327.950	590.38	0.000*
Error	156	86.656	0.555		
Total	159	1070.505			

Individual 95% CIs For Mean Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps_25dg	40	3.9150	0.6706	(-*)	
agx_25dg	40	2.5255	1.1411	(-*)	
pp_25dg	40	7.2695	0.5430	(*-)	
tml_25dg	40	0.4550	0.4188 (*)	-----+-----	
Pooled StDev = 0.7453				2.0	4.0 6.0

* significant at $\alpha = 0.05$

Table 6: Analysis of Variance of the Dot Gain Percentage at 25% Tint for the Plates

contrast since it has the largest mean value of print contrast, and its print-contrast variation is the smallest among the four plates.

Other Findings

The major issue in this section is to discuss the analysis results related to dot gain ratio of mid-tone/three-quarter tone and midtone/quarter tone ([50:75] and [50:25]). Dot gain ratio is not often discussed by printers, but it is necessary to study it for the purpose of understanding the dot reproduction characteristics for various plates. According to a recent study of Stanton and Hutton (in press) at GATF, there was no significant difference in dot gain ratios of [50:75] and [50:25] among all colors and types of paper, and the ratio should be a constant for cyan, magenta, yellow, and black. The dot gain ratio for the plates in this experiment is discussed below.

Dot gain ratio [50:75] of the plates. Table 8

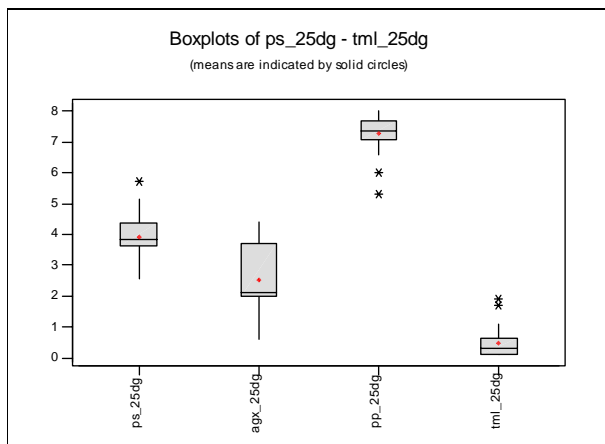


Figure 7: Boxplot of the Dot Gain Percentage at 25% Tint for the Plates

Source	DF	SS	MS	F	P
Factor	3	2254.553	751.518	1135.28	0.000*
Error	156	103.267	0.662		
Total	159	2357.820			

Individual 95% CIs For Mean Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps_pc	40	30.825	0.296	-----+----- (*)	
agx_pc	40	27.535	1.432	-----+----- (*)	
pp_pc	40	20.475	0.446 (*)	-----+----- (*)	
tml_pc	40	27.035	0.558	-----+----- (*)	
Pooled StDev = 0.814				21.0	24.0 27.0 30.0

* significant at $\alpha = 0.05$

Table 7: Analysis of Variance of the Print Contrast for the Plates

exhibits the ANOVA table of the dot gain ratio [50:75] for the plates. It indicates that there is no significant difference in dot gain ratio [50:75] among the four types of plates ($p > .05$). Figure 9 displays the boxplot of the dot gain ratio [50:75] for the plates. It shows that the heights of the boxes of the four types of plates are all relatively close and the mean dot gain ratios of the plates are also very close. Except the thermal plate, the variation of the ratio is relatively small for the other three plates.

Dot gain ratio [50:25] of the plates. Table 9 exhibits the ANOVA dot gain ratio [50:25] table for the plates. It reveals that there is no significant difference in dot gain ratio [50:25] among the four types of plates ($p > .05$). Figure 10 exhibits the boxplot of the dot gain ratio [50:25] for the plates. It shows that the heights of the boxes of the four types of plates are all relatively close and the mean dot gain ratios of the plates are very close. Except the thermal plate, the variation of the ratio is relatively small for the other three plates.

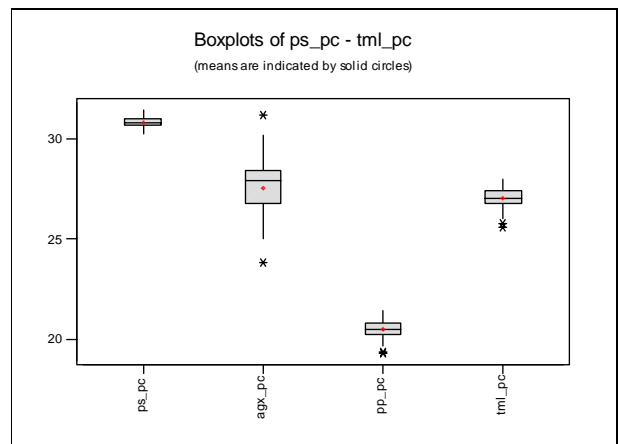


Figure 8: Boxplot of the Print Contrast for the Plates

Source	DF	SS	MS	F	P
Factor	3	5.76	1.92	1.30	0.275
Error	156	229.66	1.47		
Total	159	235.42			

Individual 95% CIs For Mean					
Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps50/75	40	1.374	0.063	(-----+-----)	
agx50/75	40	0.988	0.432	(-----+-----)	
pp50/75	40	1.148	0.071	(-----+-----)	
tml50/75	40	1.473	2.386	(-----+-----)	
Pooled StDev =		1.213		0.70	1.05 1.40 1.75

Table 8: Analysis of Variance for the Dot Gain Ratio [50:75]

To further understand in detail about dot gain ratios of the plates, Table 10 demonstrates the mean dot gain ratios of [50:75] and [50:25] and their 95% confidence intervals. It is important to note that the dot gain ratio [50:75] of silver-halide plate (.99) is very close to that of photopolymer (1.15); the difference is about 0.15. Moreover, the dot gain ratio [50:75] of PS plate (1.37) is very close to that of thermal (1.47); the difference is about 0.10. Similarly, the dot gain ratio [50:25] of silver-halide plate (1.845) is almost identical to that of photopolymer (1.840), and the dot gain ratio [50:25] of PS plate (2.31) is very close to that of thermal (2.42); the difference is about 0.11. From the dot gain ratio analyses, it is interesting to note that the dot reproduction characteristics of the PS and photopolymer plate are very similar; the dot reproduction characteristics of the silver halide and thermal plate are very alike.

Conclusions

The following conclusions and recommendations can be made based upon the findings of the

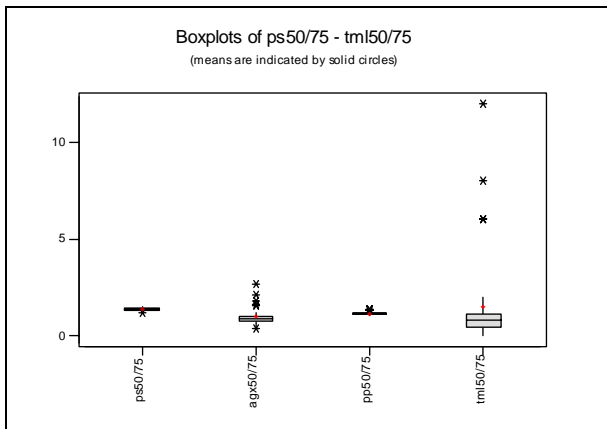


Figure 9: Boxplot of the Dot Gain Ratio (50:75] for the Plates

Source	DF	SS	MS	F	P
Factor	3	11.33	3.78	1.91	0.131
Error	156	308.75	1.98		
Total	159	320.08			

Individual 95% CIs For Mean					
Based on Pooled StDev					
Level	N	Mean	StDev	-----+-----	
ps50/25	40	2.314	0.307	(-----+-----)	
agx50/25	40	1.845	0.826	(-----+-----)	
pp50/25	40	1.841	0.102	(-----+-----)	
tml50/25	40	2.425	2.670	(-----+-----)	
Pooled StDev =		1.407		1.60	2.00 2.40 2.80

Table 9: Analysis of Variance for the Dot Gain Ratio [50:25]

study and the experiences gained from conducting this experiment:

1. The ANOVA analyses (see Table 3-7) indicated that there were no significant difference in solid ink density, dot gain at 25%, 50%, 75%, and print contrast among the conventional PS, silver halide, photopolymer, and thermal plates.
2. The silver halide plate produced the least amount of solid ink density and greatest dispersion of it among the four types of plates. (See Table 11)
3. The silver halide plate produced the greatest amount of dot gain dispersion in all three tints among the four types of plates. (See Table 11)
4. The thermal plate delivered the least amount of dot gain and dot gain variation in all three tints among the four types of plates. In addition, the mean dot gain percentages of the three tints are all smaller than 1% and their dot gain variation are all smaller than 1.00. In other words, the thermal plate has the best

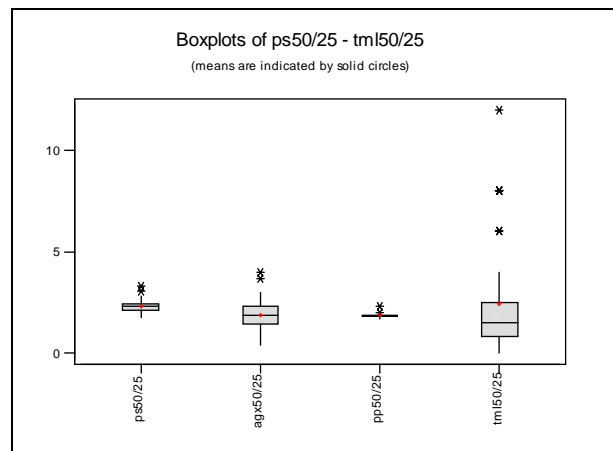


Figure 10: Boxplot of the Dot Gain Ratio (50:25] for the Plates

	[50:75]		[50:25]	
	Mean	95% C. I.	Mean	95% C. I.
PS	1.3736	(1.3536, 1.3936)	2.3137	(2.2154, 2.4120)
Silver Halide	0.9883	(0.8503, 1.1263)	1.8453	(1.5811, 2.1094)
Photopolymer	1.1483	(1.1257, 1.1709)	1.8406	(1.8080, 1.8731)
Thermal	1.4733	(0.7102, 2.2364)	2.4248	(1.5709, 3.2788)

Table 10: Mean Dot Gain Ratios and their 95% Confidence Intervals

performance on dot gain among the four plates, in terms of size and consistency (see Table 11).

- The conventional PS plate produced the greatest amount of print contrast and least amount of print-contrast dispersion. This implies that the PS plate has the best performance in the tonal range of shadows among the four plates. (See Table 11)
- From the dot gain ratio analyses, the dot reproduction characteristics of the PS and photopolymer plate are very similar; the dot reproduction characteristics of the silver halide and thermal plate are very alike (see Table 10).

This study recommends future work to investigate the dot reproduction attributes of other CTP plate materials made by different manufacturers. There is also a need to employ other plate-measuring instruments, such as the ACME Plate Dot Reader, Centurfax CCDot, or Electronic Planimeter—as recommended by GATF researcher John Lind (1999)—to read the plates.

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Plates	Solid Ink Density		Dot Gain %at 75%		Dot Gain % at 50%		Dot Gain % at 25%		Relative Print Contrast	
	Mean	Dispersion	Mean	Dispersion	Mean	Dispersion	Mean	Dispersion	Mean	Dispersion
PS	.92	.012	6.46	.340	8.87	.547	3.92	.671	30.83	.296
Silver halide	.72	.023	4.94	3.045	4.40	2.436	2.53	1.141	27.54	1.432
Photopolymer	.91	.010	11.66	.893	13.34	.617	7.27	.543	20.48	.446
Thermal	.90	.011	.77	.454	.61	.380	.46	.419	27.04	.558

Table 11: A Summary of the Attributes of the Plates

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**Yung-Cheng
Hsieh, Ph.D.**

Assistant Professor

Dr. Yung-Cheng Hsieh is an Assistant Professor in the Department of Graphic Arts at National Taiwan College of Arts (Taipei, Taiwan). He teaches courses in offset printing technology, printability, statistical quality improvement, and printing technology trends. He received his Ph.D. in Industrial Technology from Iowa State University.

The Power of PDF

Penny Osmond

Graphic Communication Department

California Polytechnic State University, San Luis Obispo

Introduction

Adobe's Portable Document Format (PDF) was originally intended as a web publishing format. PDF has become the de facto standard for many web documents. Many documents are available for download from the web in PDF format because of its ability to maintain precise page-layout while still reducing transfer rates with relatively small files. Adobe Acrobat 4.0, which retails at a mere \$189, allows users to open, edit, and create PDF files. PDF files are created with the Acrobat Distiller program that comes packaged with Acrobat. Acrobat can turn PDF files into interactive forms that can be printed or submitted electronically. Although many forms available on the web do not utilize this feature, it is a powerful tool nonetheless. As more and more tools are being developed to create and manage PDF files, the benefits to printers for a more efficient workflow cannot be ignored (Heckelman 2000).

PDF for Prepress

Although PDF will continue to be a popular web format, the benefits for prepress workflows become greater each year. The excitement generated around PDF for printers comes from its potential to make the digital workflow run smoother than current and previous workflows. The standard workflow for printing in the graphic arts industry for over ten years now has been PostScript (Padova, 1999). Printers have continually dealt with cross-platform issues, missing font problems, missing graphics, and output errors from client files in the PostScript workflow environment. PDF is cross-platform compatible, application and device independent (Leland, 2000). PDF also maintains the native application's original layout, including preservation of all fonts and graphics. PDF files are smaller than their PostScript equiva-

lent which allows for easier transfer and faster, less troublesome output. PDF files can be used for remote or soft proofing as well. Acrobat allows users to create annotations which are similar to electronic sticky notes for proofing and corrections. Once the annotations are made, the file can be sent back to the creator to implement the changes. Although digital signatures are also a feature of Acrobat, most clients and printers still prefer hard copy contract proofs.

Client Creation of PDF

According to Heckelman (2000), "high-end prepress and printing groups estimate that they spend more than 20% of their time adjusting current PostScript files for correct output." In an ideal world, a client would create a PDF file, deliver it to the prepress service bureau or printer, and everything would run smoothly for output. Unfortunately, we don't live in an ideal world even with the power of PDF at our fingertips. According to Witkowski (2000), the person designing the page should be the one creating the PDF file. This would eliminate the possibility of missing fonts and graphics and allow the creator to see what is actually being sent to the printer for reproduction. Assistance still needs to be provided to the client to ensure that a good PDF file is created to go into the production environment. The graphics contained in the PDF file still need to be set at the proper resolution and color mode. PDF files for print cannot be compressed like PDF files for the web. A web-ready PDF file may need to be created for remote proofing. Fortunately, tools are becoming available to make proper file creation easier.

A PDF file can be generated from its native file many different ways. Acrobat Distiller can generate PDF files from a PostScript file using customizable Job Options. The predefined Job

Option settings for Distiller are ScreenOptimized for the web, PrintOptimized for desktop printers, copiers and CD images, and PressOptimized for high-end output to film or plates (Figure 1). A custom Job Option should be made that is specific to a printer's particular workflow. Once created, a small file is generated with the custom information contained in the file. That file can then be sent to the client/creator and loaded into Distiller for easier creation of good PDF files. The client then does not need to know what specific settings to create for Distiller's Job Options. Since PDF files are device-independent, a PostScript file can be created from a host of different software applications using the Distiller PPD (Postscript Printer Description) file rather than the PPD file for a specific output device. Watched folders can also be set up so that when a PostScript file is saved in that folder and Distiller is open, it will automatically generate a PDF file. Although creating PDF files with Distiller is relatively simple, third-party vendors are developing software options to streamline the process even more.

Agfa has created a stand-alone software program for generating PDF files called Agfa Apogee Create. Although it was designed to create files going into an Agfa Apogee high-end PDF workflow, it will generate good PDF files compatible with any PDF workflow. Another application, available as part of Markzware's MarkzScout 2.0, is PDF Maker which will automatically create PDF files from native files (M2 Presswire, 2000). Adobe InDesign is the first software that fully



Figure 1: The Adobe Acrobat Job Options Settings

integrates into a PDF workflow by allowing PDF files to be imported directly into a layout. Final layouts can also be saved directly into a PDF file from InDesign.

Preflighting tools are also becoming more convenient to use and easier to access for the content creator to check their PDF files prior to file transfer to the printer. Both Markzware and Extensis offer on-line preflighting solutions that detect possible errors. Once the errors are corrected, the files can be transferred directly to the printer. Markzware makes a program called MarkzNet (Figure 2) while Extensis is beta testing a program called Extensis Preflight On-line. Both programs allow access and file transfer through the printer's website. Both also allow the preflight specifications to be set up by the printer. The end result is the electronic transmission of a good PDF file directly into the printer's workflow. As bandwidths continue to get larger and files created in PDF become smaller, internet file transfer can now be utilized for job file transfer. The days of only being able to send small files such as fonts and PPDs are now a thing of the past.

Options for the High-End Prepress/Printer

Current PDF workflow systems that are available for high-end prepress or production environments are Agfa Apogee, HeidelbergCreo Prinergy and Scitex Brisbane Extreme (Heckelman 2000). Each of these powerful tools offer complete PDF workflow solutions including job tracking, file



Figure 2: The MarkzNet Window

management, preflighting, trapping, and imposition. The solutions offered by Agfa, Heidelberg-Creo and Scitex all utilize the Adobe Extreme architecture which has been designed from the beginning as a scalable system for creation, management, and automation for a PDF workflow (PR Newswire, 1999). Each of these products are powerful and well-proven, but each also carries a powerful price tag. Output devices require a Postscript Level 3 Raster Image Processor (RIP) for use with these systems. Level 3 RIPs have the ability to directly output PDF files and provide high-end functions such as In-RIP trapping.

Lower Cost Options

A PDF workflow can be implemented without investing in the high-end workflow solutions mentioned above. Adobe Acrobat InProduction was released in February, 2000 as a solution for managing PDF files through a print production workflow. InProduction works in conjunction with Acrobat—similar to a plug-in—to allow for preflighting, color separation handling, color conversion, trim and bleed specifications, and defining trapping parameters (PR Newswire, 2000). InProduction itself does not perform trapping functions, but it does allow the specification of trapping for Level 3 RIPs with In-RIP trapping capabilities.

Many people think that a Postscript Level 3 output device is essential for PDF output. In reality, PDF files can be output on Level 2 RIPs if they are output from the proper software. Imposition software programs such as SenicSoft PREPS allow PDF files to be imposed and then output directly to a Level 2 RIP. Although SenicSoft maintains that PREPS version 3.5 will readily accept PDF files, PREPS version 3.7 allows for a more seamless workflow (Lam, 2000). Since PREPS does the separations a Level 3 RIP is not needed to directly output and separate the PDF files. Another software program that allows for output to a Level 2 RIP is CrackerJack made by Lantana.

PDF Editing

One advantage that PDF has over PostScript is PDF files can be edited. Self-contained PostScript files have no way of being edited, even if it is a

minor change. Since PDF is a simplified, object database of sorts (Jahn, 2000), it is possible to edit PDF files to some extent. If the number of changes are significant, it is always better to make those changes in the native file format and create another PDF file. Although Acrobat can do some minor editing, programs such as Enfocus Pitstop has made the editing of PDF files much more of a reality.

Conclusion

The advantages of PDF are abundant. PDF files maintain the original layout and contain embedded fonts and graphics. PDF files are smaller than PostScript files, can be viewed on any platform, can be transferred via the web, and may be used for remote proofing. Prepress workflows can be streamlined using PDF and files are generally simpler and more reliable for output. As more and more companies are developing software for creating, editing, preflighting, imposing and outputting PDF files the true power of PDF is yet to come.

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Penny Osmond

Assistant Professor

Penny Osmond is an Assistant Professor in the Graphic Communication department at California Polytechnic State University. She teaches courses in prepress and consumer packaging. She has taught at the post-secondary level for the past ten years in both Nevada and Idaho. Penny is currently pursuing a Ph.D. from the University of Idaho. She completed her Master's degree at the University of Nevada, Las Vegas and her undergraduate degree at Ferris State University in Michigan.

Developing a Multimedia Center to Produce Virtual Fieldtrips

Paul Majeske

Communication Technology

Eastern Michigan University

Abstract

This paper describes the equipment needed and the production methods used for preparing what I refer to as the “Virtual Fieldtrip.” Managing a curriculum based on emerging technologies and diverse equipment can be a challenge at a land-grant or state-funded university, especially when the need to demonstrate a variety of procedures and/or processes on a variety of different platforms exists. Preparing students with the Graphic Communication skills needed to survive in today’s market place is an overwhelming task. What is needed is the ability to expose the student to a variety of possible work environments. Through the use of multimedia technology, it is possible to expose students to a variety of real-life, work-like scenarios, without overrunning budgets or maintaining huge maintenance accounts.

Introduction

Using and/or developing multimedia is not a particularly new idea. However, with the declining cost of high speed personal computers and software—some of which one could only dream about a few years ago—creating interactive educational CDs is an affordable option to bring information to the student as opposed to taking the student to the source of the information. We have all tried to make a particular course more fulfilling by taking a group of students out of the classroom—a field trip. What I will describe in this paper is a method by which industry can be brought to the classroom, thus avoiding all the problems associated with taking a group off campus. I will detail the methods of production, describe possible reasons for adopting the technology, and describe the hardware, software, and training.

The Virtual Fieldtrip

In order to develop all the skills needed upon graduation to capture a job in the graphic communications industry, a school would have to have, or have access to, many different types of machines and tools. However, a “virtual” experience of those machines and tools can now be provided to students without requiring schools to own the actual equipment. Multimedia computer-based instruction can provide a virtual field trip experience by combining text, graphics, pictures, sound, video, and animation in a self running executable file that can be “played” on “middle of the road” personal computers of any platform. With recordable or rewritable CD drives becoming standard equipment on just about all personal computers, faculty can easily make copies. Also, due to the fact that faculty-made programs are produced in-house, there are no copyright issues that would be associated with the duplication of professional materials. A typical 20 to 30 minute presentation with video and associated text files can easily consume hundreds of megabytes. Compact disks are a perfect solution. The unit cost of a disk that will hold in excess of 600 megabytes is well under a dollar when purchased in bulk quantities.

Advantages and Disadvantages to Using Multimedia

There are many good reasons to use multimedia-based instruction in the classroom. The most important reasons suggested by this paper are the ability to gather information that you would not normally have access to and the ability to standardize the delivery of instruction. The consistent delivery of instruction is a huge advantage. How many times have you heard the dreaded question “did I miss anything important?” from a student who missed a class? With content stored on a CD, the information can be recalled in exactly the same

fashion which it was initially delivered. If you are teaching multiple sections of the same course, you can guarantee that all students have access to the same material. You also do not have to worry about getting students back on time for scheduled classes after a real fieldtrip or industry visit. There is only one disadvantage that has made itself apparent so far. In some cases I have found that students do not relate to the video and interactive material as well as they would a real person. In these cases, it is usually the inability to ask a specific question. However, once you get accustomed to producing the content you will learn to ask the right questions when preparing the script.

Getting Started

As I stated earlier, with a limited budget, it is almost impossible to prepare students with all of the skills they will need to capture a good job upon graduation. This fact was the major reason for researching an alternative classroom delivery system. So, where do you begin?

First, secure the funds. I was fortunate enough to get the money needed for startup from an internal incentive program offered by the University. I wrote a proposal for an instructional technology grant. This is not the only way. If you have a big enough budget, use it. You can also secure funds from local industry. If you have an advisory board for your program, put fundraising on your next agenda. I have heard from colleagues who have used all of these methods. If you are going after industry support, let them know that students from your program will have had access to the particular methods of production used in a specific location. Remind them of the time that will be saved training students who have basic skills but not specific skills. If you have students who are going into the same job location year after year, start there first.

A good starting budget should be between \$10,000 and \$15,000. It depends on how often the equipment will be used and by how many people. My goal was to have two workstations capable of producing and capturing still images. One of the two was primarily set up for audio editing and the other was set up for digital video editing. You will have to decide what kind of configuration will work best for your particular situation.

Equipment

The first question usually asked is, "Macintosh or Windows?" I do not have a real preference. Throughout my career I have used both platforms interchangeably. Macintosh certainly makes things easier. However, the added cost may be prohibitive.

The multimedia lab here at Eastern Michigan University is a Windows based system. There are many very good digital video editing components available for Windows-based workstations. I have had great luck with the Canopus DV Rex M1 combination. There are also several good software titles from which to choose. I chose software with a second purpose in mind: the Multimedia lab is a breeding ground for new course offerings.

Here is a list of all the software you will likely need:

- Macromedia Director, Authorware, or equivalent authoring software;
- Adobe Photoshop, or an equivalent pixel editing software;
- Plug-ins (any special effects you might use)
- Adobe PageMaker, InDesign or QuarkXPress;
- Adobe Premiere, or other video editing software;
- Microsoft Office suite;
- Sound Forge, or equivalent sound editing software;
- 3D Studio Max, Hash Animation Master, or equivalent 3D software; and
- Adobe GoLive, or other web authoring software if you plan to deliver anything online.

Buy the hardware last. If you are working with a school purchasing system, wait until the final moment to get your hardware—there is always a faster CPU, hard drive or video card coming out next week! An example budget is shown in Table 1.

The real heart of this concept is the digital video camera and editing system. If you haven't seen (or heard) the quality of DV yet, then what are you waiting for? There is one thing you must be prepared for: extremely large captured video files. I recommend spending time scripting the video and only capturing what you will use. As you can see from the hardware list, large hard drives and external storage is a must.

Flat bed and slide scanners	\$1,800
Pentium III 850 PC (or faster); 128 MB RAM (minimum); 40 Gig H.D. SCSI (very important); 24 MB Video; 21" monitor; SCSI controller; Jazz removable H.D.	3,000
16 × 4 CD-R (SCSI)	1,200
Projection TV for display	3,800
Kodak Digital Camera DC260699
w/AC adapter & storage media card . .	.200
Digital Video camera (w/firewire)	2,000
Macromedia Director 8 Internet Bundle . .	.970
Sound Forge or Audio editing software75
Adobe Premiere 5.1250
Cabling, Microphone & Miscellaneous . .	1,000
Total	\$14,994

Table 1: A Sample Hardware and Software Budget

Production and Training

Getting up to speed on the production of multimedia may take some time. If you have people already familiar with the software mentioned, utilize their talents. However, someone is going to have to dedicate some time. If this concept interests a particular faculty member, let him or her take charge. If you can build a position into your budget, that would be ideal. Creating a position for a graduate assistant is another option. Offering special topics, continuing education, or distance learning courses could be a possibility, too. With a course number attached to your project, you may find support from administration.

There are a number of great training videos and CDs available. I have had great success with Mac Academy and Windows Academy CD tutorials. Once you get this rolling, others will set aside time—the benefits will be seen by anyone who wants to show multiple processes, procedures, or tools.

The production is fairly straightforward. You will develop your own style of delivery. A typical project would start out with contacting an organization or industry representative. Set up a time to visit when things are going on (i.e.: presses are running). Be sure to have a complete set of questions scripted. Remember that you will get better each time you produce a project. Shoot video to

support your anticipated questions. Show as much interaction as possible.

When you get back to your lab, download the video, edit the video, and render it to make the file smaller (Adobe Premiere). Set up a front-end interface that you are comfortable with using your authoring software. Build a user-friendly method for the students to browse the information. Insert your stills, video, audio, and animation. Duplicate and distribute.

Results

What can you expect after implementation of a customized computer based multimedia system? One definite outcome will be your students will have access to exactly what you want them to see, read, or hear. You will no longer have to settle for “canned” content. In addition, you will have the ability to show current state-of-the-art processes. Many studies have been done that have shown the benefits of multimedia delivery. My own preliminary research indicates that students who use multimedia perform better and study more efficiently. Computer based multimedia instruction captures the viewer’s interest. I have also discovered through a survey instrument that students who have used a multimedia based learning system score better than others who have had only reading assignments from a textbook. Students will spend more time watching and interacting with a computer and they can go over the material several times.

Summary

I hope that you find this information useful. Putting together a facility that allowed for the production of the “virtual fieldtrip” experience has helped to build skills that would otherwise not have existed. The response by students and faculty has been very favorable. If you have the need to show new processes and you cannot find a multimedia title for them or if you live in an area that is remote or isolated this is the solution. Creating these “virtual fieldtrip” experiences can be time consuming but it is time very well spent.



**Paul
Majeske**

Assistant Professor

Paul Majeske is an Assistant Professor of Communication Technology in the Interdisciplinary Technology department at Eastern Michigan University.

He teaches courses in prepress, digital imaging, web design, and multimedia production. Prior to moving to Eastern Michigan University he taught in the Graphic Arts Management area at Central Michigan University. He holds a Masters Degree in Technology from Eastern Michigan and is currently finishing the course work towards a Ph.D. in Technology.

Graphic Communications Course Content: A Study of Student Perspectives and Knowledge of Multimedia/Interactive Web Authoring Skills

*Lesta A. Burgess, Teresa J.K. Hall, and Shahram Varzavand
Department of Industrial Technology
University of Northern Iowa*

Introduction

The exponential increase in Internet availability and utilization in the past decade has changed the way we do business, teach courses, and entertain ourselves at home. We can easily access information that, until recently, would have required a trip to the library or city hall or school or bank, many phone calls, and tedious scheduling of meetings with key personnel. Be it on-line databases, corporate websites for technical support, or courses for college credit, the Internet is generally the first place people turn to for information, research, and communication.

Thus, the initial encounter we have with any given Web site can have an impact on our success in accomplishing the task we have set out to accomplish. Web sites that are properly constructed are information systems that efficiently structure content to provide visitors with knowledge and insight. Web sites could also be considered facilitators or purveyors of new ways to experience knowledge by connecting users to other worldly experiences (McKenzie, 1997). Therefore, a good web site has aesthetic appeal, clarity of content and purpose, and ease of access to linked information. This often differs from traditional methods of communication or information seeking in that Internet users are able to make more decisions regarding the breadth, variety, quality, and/or type of information they choose to use. "A unique feature of web pages is their ability to allow input from the user" (Luck & Hunter, 1997).

In addition to using the web as a knowledge and communication resource, it is increasingly used for consumer retail purchases, business-to-business (B2B) ventures, and as an adjunct to marketing campaigns. Research has shown significant growth in online purchasing capabilities for all types of consumer goods and services. The largest

purchases made by consumers in 1999 were books, followed by on-line auction items (Intermarket Group, 1999; Studt, 1999).

Within the Graphic Communications industry, commercial printers see e-commerce as complementary to printing, allowing them to serve their customers via digital or traditional media. Many Graphic Communications professionals see the explosion of digitized information as a way to create new opportunities to expand services such as web page design, on-line ordering, and CD-ROM development. They realize that flexibility and technological innovation is key in order to continue providing valuable services (Leland, 1999). Narain (1999) stated that only about 30% of the business done for InPrint Corporation was printing while another 30% was software duplication, web hosting and copy-center outsourcing.

Review of the Literature

Higher Education, Students, and the Web

In light of the changes within the Graphic Communications industry, educational environments have also shifted to take advantage of the web and other electronic media. There are a growing number of institutions of higher learning offering online classes, which provides flexibility to both instructor and student. "Web-based educational systems are asynchronous, that is, they do not require simultaneous presence of teacher and students" (Ausserhofer, 1999). Schools are finding innovative ways of using the Internet to engage students in real world problem solving. Web sites have the ability to offer the vehicle to support such studies as they become information warehouses, virtual museums or virtual libraries storing the raw

data until students may visit to extract meaning and insight (McKenzie, 1997).

Many universities have access to an integrated learning program known as WebCT, which was developed in the Department of Computer Science at the University of British Columbia. WebCT provides a secured environment for the placement of course materials, including syllabi, assignments, lectures, and presentations on the Web. It is an easy-to-use tool for creating sophisticated Internet-based courses. Research at Creighton University found students accept the use of WebCT and some students found they could focus more of their attention on the subject and learn more quickly. It was also found that WebCT provides important exposure to the technology associated with many disciplines (Morss, 1999).

As the Internet grows and evolves to meet business and educational needs, it begs the question as to what function and/or role will graphic communications graduates take in this digital marketplace. Dramatic increases in the use of the World Wide Web for communication and commerce by the industry, education, and the public in general have superceded the current capabilities of frequently simplistic web site design courses that are being taught on university campuses. The growing availability of high speed Internet connections give users greater access to text, audio, and video in a reliable and timely manner, but unfortunately, has exceeded the capabilities of the Hyper Text Markup Language (HTML).

Overview of Multimedia and Web Authoring Tools

The benefits associated with understanding student perceptions and benchmarking current knowledge of web authoring tools could serve as a starting point for curriculum content decisions. In today's multimedia and interactive web environment, "effective" information can no longer be delivered via Hyper Text Markup Language (HTML) alone. Web sites using Java Applets, JavaScript, Streaming Audio and Video, Virtual Reality (VR), and other functional interactive multimedia elements are the norm. Web sites lacking interactivity usually fail to keep visitors' interest and a "mouse click" is all that is needed to trans-

port an Internet user from a mundane web site to a more appealing one. Thus, the web designer's challenge is to delay that "mouse click" as long as possible, and to offer the site visitors exceptional interactive experience during their time at the website. The widely acceptable eXtensible Markup Language (XML) and Wireless Markup Language (WML), in addition to the Internet user's desire for Web site interactivity and remote accessibility, will challenge Web site developers and administrators alike.

Virtual Reality and Internet. Information visualizations on the Internet with the aid of Virtual Reality have transformed the traditional visual presentation. Virtual Reality Markup Language (VRML) allows a website designer, and ultimately the Internet user, to immerse themselves in and navigate through a virtual world. Virtual reality is becoming standard part of many web sites offering visitors a unique and memorable experience (Ressler, et al., 1997; Rhyne & Taylor, 1997). It is being used by nearly every electronic store on the Internet regardless of whether they are part of new economy or a brick and mortar economy. The uses of virtual reality are as varied and diverse as Internet sites. Contractors have used virtual reality to offer homebuyers a walk-through tour, while automotive manufacturers enable the car enthusiast to examine their latest models (General Motors, 2001). Educational applications include a Virtual Tour (VT) of the human anatomy or a virtual transport to an endangered rainforest. It is obvious that virtual reality has the capacity to revolutionize learning. Recently a consortium of government and private agencies have developed a virtual reality training tool (InterFIRE VR) to aid and train fire investigators (Sullivan, 2000). The limitations on virtual learning are only limited by our imagination.

Internet Access Via Wireless Devices. It is difficult to miss a cell phone tower regardless of whether they are concealed in a palm tree, church steeple, or light-pole. Consumer desire for wireless communication has grown to more than 60 million customers who use digital and analog cell phones or Personal Digital Assistants (PDAs) (Cellular Telecommunications Industry Association, 2001). Unlike Web browsers (Netscape Navigator® and Internet Explorer®) which are capable of deciphering HTML, wireless devices require only text

and therefore use Wireless Markup Language (WML). Furthermore, narrow band (slow speed with which these devices communicate) capabilities of handheld devices and desire to access the Internet by the consumer via their cell phones and PDAs are forcing web developers to modify (recode and strip multimedia content) their creation to accommodate this new phenomenon.

Streaming Video. Rapid technological development in web server design and advances in compression/decompression algorithms have revolutionized broadcasting live and prerecorded audio and video over the Internet. Streaming audio and video have become routine elements on interactive web sites. Because of its promising future, investments by venture capitalists in this single Internet technology have increased significantly (worldlyinvestor.com, 2001)

Major universities currently have or are in the process of streaming lectures to their extended campus. But what are the implications of streaming video? Is there a special script or HTML code? What should be the network topology? Can it be accessed via 56K modem, Digital Subscriber Line (DSL), or does it require a T1 connection? Basic knowledge of computer network, video processing software, and graphic browser capabilities are necessary to decide what video/audio format needs to be streamed. Fundamental knowledge must be accrued and understood by web site developers (graphic communications majors) in order to integrate video into a commercial or otherwise client web site.

Graphic Communications

The Graphic Communications Council provides this definition of Graphic Communications:

The processes and industries that create, develop, produce, and disseminate products utilizing or incorporating words or pictorial images to convey information, ideas, and feelings. These products facilitate learning, enjoyment, motivation, and commerce. Graphic Communications includes the family of market segments embracing the technologies of printing, publishing, packaging, electronic imaging, and their allied industries; they are often referred to as the graphic arts, print, or

imaging industries (GCC, 2000).

The field of Graphic Communications encompasses all phases of graphic communications from origination of the idea through reproduction, finishing, and distribution. This includes image generation, designing and posting Internet web pages, interactive multimedia, and desktop publishing (GCC, 2000).

Curriculum for Graphic Communications programs must deliver current or emerging technological skills while still addressing fundamental problem-solving, critical thinking, and analytical skills. Faiola (1999) believes a balance must be sought between the two areas—new technological skills and thinking skills.

Yet who is responsible for building commercial web sites? According to the previous definition, it would seem that persons in the Graphic Communications field should be designing, creating, and building web sites. They should also know the limitations and capabilities of the Internet. This could be construed mean that instructors in Graphic Communications programs should be teaching students the fundamentals of web page development and Internet technology, particularly since in Graphic Communications is the third largest manufacturing industry in the United States. It requires millions of people in a variety of challenging technical, creative, or professional occupations (GCC, 2000, May 12).

The Study

After reviewing the literature, it was found that there are few, if any, studies that have attempted to determine critical knowledge, abilities or perceptions of current practitioners in the field of web page authoring tools. This may be related to the rapidly changing nature and/or the currency of the topic. For these reasons, a study was conducted to address the following issues: 1) how is information on the web utilized by Graphic Communications students? 2) is developing interactive web pages important to their future careers? 3) how knowledgeable are Graphic Communications students on web design using streaming, specialized software, networks, and/or e-commerce?

Since Graphic Communications is the discipline that could be teaching this subject material, students in Graphic Communications courses were

a logical starting point for investigation. These students will be the web page designers and multimedia practitioners in the near future.

Determining what perspectives and knowledge they currently possess might give clues as to their abilities and future needs and would be a starting point for curriculum content decisions for post-secondary Graphic Communications programs.

Method

The subject of inquiry was current student perceptions and knowledge of web page development and support tools as a way to help determine expanded or additional curriculum in a Graphic Communications program of study for post secondary education institutions. The study was conducted at the University of Northern Iowa, Cedar Falls, Iowa in May of 2000. The subjects were undergraduate students (n=143) enrolled in three classes in the upper level division and three classes in the lower level division of graphic communication courses during the Spring and Fall 2000 semesters. The first section of the survey included dichotomous and open-ended response questions regarding current web page activity, perceptions of the importance of web page authoring skills to future employment, and interest in web-based courses. The second section of the survey asked the participants to rate their abilities on a variety of web authoring and support tools using a scale with responses limited to "high," "medium," "low," and "none." The last section of the survey asked the student's major, minor (if applicable), and undergraduate rank.

After the surveys were administered, the data was analyzed using SPSS software. Descriptive statistics were calculated including frequency, percentages, and mode values for each item where the data could be coded. For open-ended questions, the data was compiled and analyzed for common themes to guide future study.

Results

The first section of the survey inquired as to current web activity, importance for career or personal use, and interest in web courses. The frequencies, percentages, and mode for these items are displayed in Table 1. For question one, the

Question	Response	Frequency*	Percentage*	Mode
1. In what web interaction do you currently participate?	Information search	117	81.8	X
	Feedback	27	18.9	
	Web course	23	16.1	
	Other	26	18.2	
2. Is learning to develop web pages important to your career field?	Yes	105	73.4	X
	No	37	25.9	
3. Would you like to develop a web page activity for personal or employer use? Yes/No/Which?	No	29	20.3	X
	Yes, personal	52	36.4	
	Yes, employer	16	11.2	
	Yes, both	45	31.5	
4. Are you interested in courses delivered exclusively through the Internet?	Yes	85	38.5	X
	No	55	59.4	
	Maybe	1	0.7	
5. Would you enroll in an Internet-based class?	Yes	64	44.8	X
	No	28	19.6	
	Maybe	51	35.7	
6. Is it important to know web page design details?	Yes	120	83.9	X
	No	16	11.2	

*Missing data not included in frequency and percentage calculations.

Table 1: Survey Items Regarding Current Web Activity and Interest

'other' category elicited responses such as e-commerce, searching for design elements, and work assignments.

The second section of the survey sought to determine the perceived level of student knowledge and ability for a variety of web authoring software and tools. The students were asked to rate themselves on ten items related to web page development and support. These included web authoring software or programming language, virtual reality markup language (VRML), streaming, JAVA language, JAVA script, Visual Basic or Active X, synchronized multimedia integration language (SMIL), and wireless markup language (WML). The results for these questions are shown in Figure 1. The students were also asked to rate their knowledge of computer networks, e-commerce and web site administration. The answers to these questions are depicted in Figure 2.

Demographic information was also collected from the respondents. Although a majority

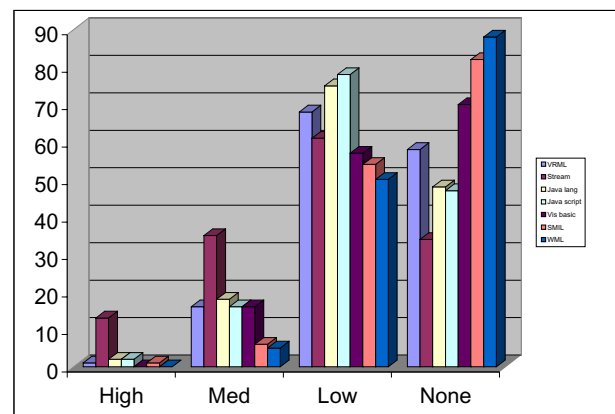


Figure 1: Frequencies of Student Ratings of Abilities/Knowledge of Web Authoring Tools

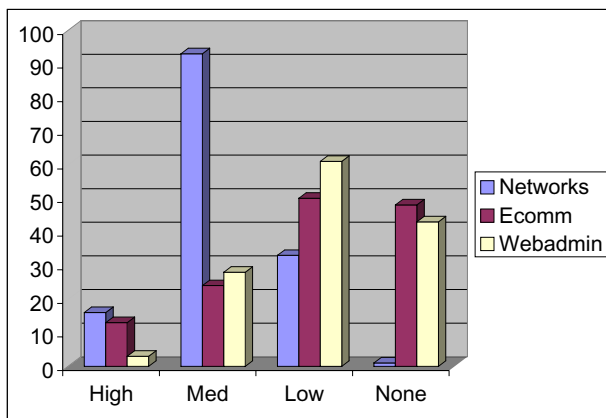


Figure 2: Frequencies of Student Ratings of Abilities/Knowledge of Web Site Related Activities

(35.7%) were Graphic Communications majors, there were others who were majoring in related fields such as Technology Management (16.8%), Graphic Design (4.2%), Marketing (4.2%), Public Relations (1.4%), and Art (2.8%). It should be noted that the Technology Management program has a technical elective track that emphasizes Graphic Communications, thus the data collected from these students is relevant to the study. In addition to these majors, it should be noted that Technology Education majors constituted a large percentage (22.4%) of student respondents. These pre-service teachers also may choose to work toward licensure in the graphics area if desired.

The remaining student majors appeared to be students from a variety of disciplines taking a graphic communications course as an elective. The students who had declared minor concentration were primarily in the Graphic Communications or Graphic Design programs. With regard to academic rank, the majority of the students participating in the study were juniors and seniors (74.9%) with the remainder being lower classmen.

Analysis and Discussion

After organizing and summarizing the information collected from the survey participants, the following observations could be made regarding student perceptions and knowledge of web page development and supporting software tools. Considering the need for knowledge of web page development, it was found that 73% of the students believed it was necessary for their future careers and 84% considered knowledge of web

page design important. Conversely, courses offered over the Internet were not a preferred method of learning: 59% responded that they would not be interested in a course delivered exclusively through the Internet, and only 45% of the participants indicated they would be interested in enrolling an Internet-based course.

The results associated with student ratings of their abilities and knowledge of web page authoring and support tools made it apparent that there were few respondents who perceived they were well versed in some of the more complex tools available to web page developers. The students' strongest area of ability and knowledge was in computer networks and web-site administration. It should be noted that 65% of the students rated their knowledge/ability of networks as "medium," while 42% rated themselves as "low" for web-site administration.

For the items that identified specific web authoring software or tools the majority of responses fell in the "none" category of knowledge. The actual percentages for no knowledge of the web-authoring tools were as follows: VRML—40.6%, streaming—23.8%, Java—33.6%, JavaScript—32.9%, Visual Basic—49%, SMIL—57.3%, and WML—61.5%. It would seem that when the technology in question is a newer or more complex, fewer students perceived they possessed ability or knowledge. This may be a reasonable outcome, since many applications that are introduced in the dot.com world must acquire critical mass (i.e., a strong following or proven performance) before becoming widely accepted or well known. Thus, many web-authoring tools that have been on the market for some time, such as Java or streaming, have better infiltration into Graphic Communications populations.

In responding to the question of knowledge/ability with e-commerce, 26% of the respondents rated themselves as "high" or "medium" in their capabilities with this medium. It is interesting to note that nearly all of the marketing majors among the study participants rated their knowledge/ability as "high," which would indicate that they are well prepared in this rapidly growing area of commerce.

Overall, it would appear that there is strong interest in web-page authoring tools and software among current students who have a vested interest in Graphic Communications as a discipline and

possible future profession. They understand that web-page design will be a part of their future. However, their knowledge/ability with these tools appears to be limited and in need of further development if they are to master these necessary technical skills.

Conclusion

Less than two years ago, the only requirement to develop a website was knowledge of HTML. Today, however, a web site is considered as a sophisticated strategic marketing or learning environment which must offer personalized interactive experience to each visitor. The issues of interactivity and efficient transfer of multimedia information via the Internet, combined with the problem of cross platform compatibility among various graphic browsers, has produced a titanic challenge for Web sites developers and administrators. The main implication of this in the context of web interactivity is the development of pragmatic and dependable web sites that fulfill every visitor's requirements. This study may very well be leaving educators asking: 1) What will be the role of graphic communications graduates in this new world of information technology? and 2) Are we allowing web site development to become an esoteric technology to our graduates and ourselves?

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**Lesta
Burgess, Ed.D.**

Assistant Professor

Dr. Lesta Burgess is an Assistant Professor in the Department of Industrial Technology at the University of Northern Iowa. She teaches in the Graphic Communications program. She serves as the liaison for the department Advisory Board and is the President-Elect of the Student Chapter of NAIT. Her research interests include graphic communications curriculum development, multimedia, web design, advisory councils and distance education.



**Teresa
Hall, Ph.D.**

Assistant Professor

Dr. Teresa Hall is an Assistant Professor in the Department of Industrial Technology at the University of Northern Iowa. She teaches in the Manufacturing Technology program and serves the Department as Manufacturing Program Coordinator and the Undergraduate Curriculum Committee Chair. Her research interests include curriculum development, manufacturing resource deployment, and distance education.



**Sharam
Varzavand, Ph.D.**

Professor

Shahram Varzavand is a professor in the Department of Industrial Technology, University of Northern Iowa.

His research interest are e-commerce, e-education, Internet applications in project administration & facility management, and Internet security.

Starting an E-Business: Putting Your Printing Business Online

*Sandy Goncarovs, Monika Zarzycka, and Aurora Villafranca for Professor Jerry Waite
Industrial Technology Department
University of Houston*

Before you actually begin designing your e-business site, it is essential to detail on paper everything you may want to include in the site. These sketchings will eventually guide you to what is best for your site, whether you use all of the ideas or not. Sit down and brainstorm for as many days or weeks as it takes until you have considered every aspect of your web-based business. As with any other production job, the planning should be the longest and most detailed step—if it is done thoroughly everything else will fall into place.

This article is based on the assumption that you already have a printing business that you wish to bring online, therefore we will leave out the steps of understanding your target audience and how to set up credit card payments, things we assume you already understand. Instead, we will guide you through the basic steps to put your existing printing business onto the World Wide Web. The steps we will outline are:

- Naming the site
- Designing the site
- Building the site
- Choosing a server service
- Keeping it fresh

By following these guidelines, you will have the basic tools for creating a successful site and putting your printing business online, as well as keeping the web site up-to-date so you can keep your competitive edge in the printing marketplace.

Naming the Site

The first step in our guideline for putting your printing business online is naming your site. A domain name is a name given to your IP (Internet Protocol) address that will also work along with your IP address to contact your site. In other

words, a domain name is the address by which your web site can be accessed. Choose a name that identifies your business, for example: www.yourcompany.com. In this form, your clients will be able to access your web site in a way that is both familiar and easy to remember. We detail the topics of IP addresses and ISPs (Internet Service Providers) more thoroughly in the “Choosing a Server Service” section—at this point we will concentrate solely on naming the site.

Check the Availability of Your Choice

While brainstorming ideas for domain name sites, write down several alternative choices. Check to see if the names are available at www.register.com or at www.e-names.org. Both companies allow you to check availability of domain names for free and both offer hosting plans and domain name registration for a fee.

Registering your Domain Name

There are two ways to register a domain name: through an ISP, for a fee, or by yourself through companies, such as those mentioned above, which also offer this service for a fee. Some ISPs do this service for free if you host your site on their server. However, doing this gives them the ownership rights to your domain name. If you decide to change the ISP hosting of your site you lose the rights to the domain name and IP address. For this reason, we recommend that you register your domain name yourself.

A good place to research accredited domain name registrars is www.Internic.net. This site provides an accredited registrar directory that lists registrars accredited by ICANN in alphabetical order, by location of registrar, and by language supported. ICANN is the Internet Corporation for Assigned Names and Numbers, and only accred-

ited registrars are listed on this site. The InterNic site also has an FAQ link that provides answers to a wide variety of questions, including: what a domain name is, how to register and how long the registration will last, and what the rules are for registering names ending with uk, us, and other country code top level domains (ccTLDs).

Many companies also have a service called domain parking where the company charges a fee to keep your domain temporarily on their server. Even if you are not quite ready to host your site on a particular server, you can still register your domain name and get started that way.

Fees

Once you register your domain name, you must pay an annual fee to keep it. Fees vary considerably, but we found the mean price of registering domain names to be approximately \$30-\$35 US per year, and \$60-\$70 US per two-year contract. There are many companies, and prices do fluctuate, so it is important that you do your research.

When you have purchased the domain name for your business, it is time to design the site. The next section evaluates the criteria for successful web site design.

Designing the Site

For inspiration, as well as examples of what to avoid, surf around online to see what your competitors are offering and what their sites look like. After choosing the best aspects of the competitors' sites, draw a thumbnail or a rough sketch of your own site.

While designing your site, consider its complexity: the number of pages; the number of elements on a page (photos, articles, forms, headlines, etc); site revisions (frequency of updates to the pages—daily, weekly, monthly, or less often); and interactivity (the dialogue between a user and your site).

Plan the interface between the site and your customers; the interactivity between customers and web pages; customers and you; and customers and one another before you get into details of technically composing your web site. Design of human interchange should precede detail design of the computer interchange.

Also remember that the image you project online is just as important as your physical presence. In person it takes only few seconds for us to form a first impression. This is also true of your Internet presence. You have only a few seconds to grab the attention of the shopper, and your introduction comes through your home page.

The best advice for designing a site is to keep it simple. Achieve the best balance of graphics and text and minimize excessive use of graphics to reduce the time it takes to open your site. If it takes too long for your elaborately-designed web site to display fully, the client may not wait to view it. An excellent example of a very well-designed site is that of Performance Printing in Atlanta, GA found at www.performanceprinting.com. It adheres to the following dos and don'ts; it is altogether a highly effective site for any printing company.

Dos and Don'ts of Online Stores

DO:

- Open with a strong introduction.
- Design creative visual images.
- Keep your web site organized.
- Create a company image that makes your web site stand out.
- Avoid a cluttered visual images (too many banners, too much information)
- Reinforce your brand image.
- Use short, concise phrases in your narratives.
- Vividly describe your products and services.
- Let shoppers get to the product they want in three clicks or less.
- Build in customer interactivity – let them be involved in the site.
- Refresh your web site regularly.
- Include testimonials from satisfied customers to support product quality.
- Offer a guarantee, prominently placed near your order form.

DON'T:

- Save your best page for last—many shoppers will leave you if the home page is dull.
- Overwhelm the user with excessive photos and graphics that take too long to display.
- Follow a template (one size fits all) if it does not suit your business goals.

- Fill each page and allow little “white space.”
- Design without concern for your brand image.
- Rely too much on narrative.
- Use long-winded wording to get to your point.
- Design too many pages that must be clicked through sequentially.
- Structure the site without allowing the client to deviate from your pattern of response

Examples of What to Include in Your Web Site

- *Company description, mission statement, products and services offered page.* This page should give the concise bottom line about what your company does. You should include equipment types, prepress, finishing and binding, etc. Be detailed and specific, but concise. Specify what types of press(es) you have, and include maximum sheet and image sizes.
- *Estimate page.* Replicate your in-house estimate form. Include fields for type of job, quantity, colors required, type of paper, number of finished pages (both folded and flat), one or two-sided job, how job should be mailed, name address, phone number, etc. You should also include a field that specifies the format in which the customer will send the job. This includes: type of disc (Mac/PC) and file format, or art send through mail, as well as how does the customer wants to receive the job (UPS, FedEx, or whatever you ship your finished jobs). A field specifying date of the finished job is also required, as well as fields for special details: embossing, die-cuts, bleeds, etc.
- *Order form.* Same as your in-house form. This page should include the same fields as the estimate form, and you should add the delivery address and type of payment. Also include fields for wrapping and shipping instructions.
- *Contact us page.* You should give physical addresses of the company and links to your e-mail account. It is a good idea to have fields for customers to write ideas, suggestions, and any opinion they may have that would help you “improve” your site and keep the site updated.

Promoting Your Web Site

Extensive promotion of your web site from as many different media as you can afford will pay off. If you have a great site that nobody can find, you will make no money. By creating a professionally designed web site, you will already be armed with an effective marketing tool. However, you will need to do more to succeed, both online and offline.

Online, it is a good idea to register your web site with search engines, so customers can easily find your site. Consider several search engines such as Yahoo!, Lycos, or Google. You can also join a listserv for the print industry by typing “listserv” in a search engine.

Other online options include banner advertising (placing an ad banner with a link to your site on other sites for a fee), getting related sites to place links on their sites to your web site, direct e-mail marketing, registering with online yellow pager, and more. www.911websolutions.com can arrange for all of these services (including search engines), either individually or as part of a package.

Offline, list your web site address on all your printed materials. This includes business cards and stationary, brochures, flyers, all newsletters, articles, handouts, and direct mail. Make the web address part of your name. Depending on your budget, you can also consider advertising on radio or television.

When the design for your site is complete, the next step is to build it. The following section covers building your site and provides links to useful sites on the subject.

Building the Site

There are several ways to build a web site. You can choose to have a professional build the site from your design, or you may create a simple page with software designed to create web pages, such as Adobe PageMill or Microsoft FrontPage. You may also use a template, such as Mercantec Storebuilder. Or you may choose to build the site yourself. If you choose this option, find a tutorial that walks you through a step-by-step project. There is no better teacher than experience, and designing a page by yourself may give you satisfaction and confidence in your own abilities.

Tools

Building a site yourself requires only a browser, a text editor and a basic knowledge of HTML. HTML is Hyper Text Markup Language, the codes you type into your text editor that tell the browser how to display your page.

Use a simple text editor when writing your own HTML. HTML editors are nice when you are familiar with HTML, but you should learn the basic concepts before using shortcut tools. Windows' NotePad or Macintosh's SimpleText are recommended to start out with. Otherwise, beginners may find that HTML they have written with a word processing program is displayed on the browser as nothing but nonsense text and symbols.

HTML is written with tags, or special codes, between the < and > signs. For example: <h3>Building the Site</h3> means that the headline "Building the Site" will be displayed on your browser as heading-type 3 in the document you are creating. Notice the slash in the first part of the closing tag: </h3>.

Most, but not all, HTML tags have both an opening and a closing tag so the browser knows when to stop applying a particular format to a line or body of text. Notice that the <p>, or paragraph, tag in the example below has no corresponding closing tag, </p>. The paragraph tag is one of the few HTML tags that does not require a closing tag. Luckily, these tags are few so it is easy to remember the tags that do not have closing tags.

The basic structure of any HTML page is very simple:

```
<html>
<head>headline title</head>
<p>
<body> body of text; may be as long or short
    as you wish it to be. </body>
</html>
```

HTML tags are not case sensitive; <BODY> body of text; may be . . . </BODY> would also work but it is faster and easier to format tags in lower case. The text within the tags, however, will be displayed exactly as you type it, so case is important here. For example, if you displayed the text formatted above in a browser, it would read exactly as it was typed:

headline title

body of text; may be as long or short as you wish it to be.

We did not specify a headline type, such as <h1>, <h2>, etc. so the headline is displayed as the same size as the body of content text.

To display the text that you format in your simple text editor, follow these steps:

- type a simple document using the HTML format shown above
- save your document as a text file (ASCII text if you are using a word processor) with an .html extension to a location on your hard drive
- go to your web browser and open a new window: File; New; Navigator Window
- when the new window opens go to File; Open Page; find the location of your saved .html file in the pop-up screen and open the file.

The file will display exactly as you have formatted it.

Tutorials

There are so many books and online tutorials available in HTML writing that the real difficulty is choosing a good one. Beginners should choose a step-by-step tutorial that explains the meaning of the lesson at the same time the student is performing it. This way, if a mistake is made, the student can go back through the last several steps and find the error easily.

Web Design with Jean Kaiser, found at www.webdesign.about.com, is a very basic tutorial for beginners. Click on the "Getting Started" link on the home page to find the tutorial. She divides the tutorial into three sections, each with links to other helpful sites relevant to the section. The first section gives a short overview of HTML. The second section discusses graphics. The third section reviews hosting services, servers, advertising your site: all important issues touched on in this article.

One of the best and most in-depth tutorials found online today is *Writing HTML*, by the Maricopa Center for Learning and Instruction at www.mcli.dist.maricopa.edu/tut/index.html. This tutorial takes the beginner through a 29-step instruction that creates a beautiful, interactive site

about volcanoes. The tutorial begins with the definition and use of HTML codes and has the student writing simple HTML in the first lesson. The final lesson is about multimedia: animated GIFs, sound, and more. By the time you have completed all the lessons, you will be capable of creating a professional site with frames, animation, sound, tables and more. Of particular interest to printers are the sections about creating forms and links: things you will need in your own web site.

Many of the lessons are short and easy. Some are broken into sections: a), b), etc. These are the final three lessons, and lesson eight, which is about different ways of linking with anchors. You can work online or, if you prefer, download the files so that you can work offline. This means that you will be working from a printed version instead of navigating between windows on your screen, but working online is good practice for getting comfortable with moving around in several windows.

You may not feel that you want to complete so many lessons to create your own site, and if this is the case, a professional web builder may be your best option. If, however, you want to learn about HTML and want to design your own site, this tutorial covers everything you will possibly need to know.

When you have created your site, the next step is to get it online for business. You must decide if you want an ISP host your site, or, if your business is large enough, you may want to invest in your own server. The next section covers these issues.

Choosing a Server Service

In order to host your web site there are two main options and several considerations that must be taken into account. The two options are to have your site hosted by your ISP (Internet Service Provider) or to have your own server and run your own site. For either one of these choices you must have an ISP, and an IP (Internet Protocol) address and it is recommended that you also get a registered domain name for your site.

ISPs

Your IP address is issued to you by your ISP and it is the way your clients are able to contact your site. An IP address is made up of a set of

numbers that locate, via a browser, the server where your web site is being hosted. Since numbers are hard to remember and for the most part, have no meaningful association with your site, a domain name is recommended. A domain name is a name given to your IP address that will also work along with your IP address to contact your site. For example, instead of typing in 196.94.78.20, you would type in www.your company.com (addressed in the “Naming the Site” section).

Now, you must decide which server you want to host your web site—the server of an ISP or your own server. If you choose an ISP you can go with the one that you chose to get your IP address. They will host your site on their server; this includes dealing with everything from the backup for that server, the maintenance, 24-hour monitoring, and administration. They will also make changes for you. There are web sites that help you in the process of choosing an ISP to host your site, like www.hostfinders.com where you enter the starting service price and ending service price that you are willing to pay. They, in turn, will provide you with a list of service providers along with their system platforms, account types, storage space, bandwidth, monthly fees, and set up fees.

Servers

When you have your own server, you are the one responsible for hosting your site and have the responsibility of backing it up, securing it, and monitoring it. Decide if you want your server run 24 hours a day or only upon request, and think about what kind of equipment to use. If you have a server configured to run upon request, it runs on one program that takes requests on certain ports that are assigned to services. When a request is made the program processes that particular request. But if the number of requests for a service is too high, the program begins to terminate some of these requests and then not all of them will be handled. The more popular choice is a constantly running server.

You will need an ISP, an IP address, a registered domain name, a machine, a means to get connected (i.e. modem), a UPS (Uninterruptible Power Supply), and a web server software to run your server (i.e. Apache). You may need network hard-

ware to connect to your ISP network (i.e. Ethernet)

It is best to use a machine that will be used as your server only, so that requests are handled faster. Do not spend too much on your machine; start small but buy something that you can upgrade easily as your site grows more successful. Also consider getting a multi processor system or motherboard; start off with just one processor and make sure that each CPU (Central Processing Unit) has plenty of cache RAM (Random Access Memory). If you run your server on a machine that also handles other tasks, it will run much more slowly and take more time for clients to access the site. If your printing business is small, you can probably get by with a modem only to set up your server.

A 56k modem can handle an average of 200 requests a day. If your requests are more numerous than this, or if your site has many graphics, consider getting an ISDN modem—more costly but able to handle about twice as much as the 56k modem. Another option is connecting your server via cable and DSL (Digital Subscriber Line) modems. DSL modems give a high degree of connectivity to your server by offering between 128k to 7.1 Mbps. Cable modems run between 300 Kbps to 1.5 Mbps. Both of these modems usually run faster than those previously mentioned and vary as to how much information you can get and receive. Remember that each of your options varies greatly in price and performance; it is imperative that you plan ahead depending on the daily number of customers you anticipate and the size of your budget. It is probably best to start off with a 56k modem and upgrade from there, depending on how well your site does.

Your IP address is the one you will assign to your server. You also need to buy a UPS so you can keep your server running during power outages, or have it shut down and start up during and after power outages. You need to consider the type of OS (Operating System) you are going to use (i.e. Unix, Windows NT, Mac OS). The OS you choose will manage all the functions of your server and will determine its security and reliability.

Next, you must choose the type of web software also known as HTTPD (Hypertext Transfer Daemon) to run your server with. This is the soul of your server, and the software you choose can

vary from free to hundreds of dollars. Each software has different capabilities to run your hardware configurations and OS. You don't have to spend a lot of money to obtain this software; in fact, one of the most popular ones, Apache, is free and works well. Other popular software are Microsoft's IIS, (Internet Information Server) and Netscape Web Server 4.1 Enterprise. If you prefer Apple products, the Mac OS X Server is available.

The Apache software is free to modify and redistribute and can be downloaded at the Apache web site, www.apache.org, as a source or as a binary package. If you decide to download as a source, you must compile the source code yourself. This will give you more flexibility to custom-tailor your installation. If you are not knowledgeable in these matters it is best to download the binary distribution. Although it gives you less flexibility, it is already compiled for you. The Apache software originated from a UNIX system but works on Windows and NT platforms. If you need help installing the software there are many books that aid you in this process, such as *The Apache Server Bible*, by Mohamed J. Kabir.

Microsoft's IIS Server is made especially for Windows NT. You can download this software, as long as you first purchase a Windows NT server, and download it from Microsoft's home page www.microsoft.com/ntserver as part of the Option pack of the NT Server. However, they do not provide the source code for you. This software is not supported by UNIX systems and runs only on Windows NT Servers.

Netscape joined an alliance with Sun Microsystems and now offers the Web server 4.1 Enterprise. You can download it for a 60-day trial and purchase it for \$14.95 per CPU. The Enterprise software offers technical support and can run on both Windows NT and UNIX systems.

The Mac OS X Server can port standard Unix server applications, and the latest version features updated versions of all its components, including QuickTime Streaming Server, and Macintosh Manager. It also features the usual user-friendly graphics interface that helped make Macintosh so popular. The Mac OS X Server is available at www.apple.com/macosx/server for \$499.00, excluding tax and shipping.

To start off with, the best bet may be Apache

since it is free, and is the most popular, widely used software available.

After downloading the software, check to see if you must decompress it. The software will not run unless you decompress it first. You will know if you have to decompress it if the filenames end with .zip, .z, .gz., .z, or .tar. If you are using Windows and the filename has the ending .exe you can probably just double click on it.

Once you can run the software on your server make sure that you are the administrator for that machine. Since the software to run a server is an HTTP daemon, you must integrate it to your OS. Servers usually install a default home page so you see if you have installed your server successfully.

Problems with installation can be due to not enough RAM, or lack of permission to use a certain directory. Or, you might not be able to access the default port for installing an HTTP, which is Port 80. Try running the software on a different port, a popular one is Port 8080. Most of the software you buy offers technical support—take advantage of this.

After you install the software on your server, access it via your browser or better yet, from another computer to make sure it is up and running. Programs known as benchmark programs can test your server's ability to respond to requests and determine how fast those requests were handled.

Once a server is running your site, either run by you or by your ISP, find out how much bandwidth your site is creating. Bandwidth is the capacity and speed of your server's requests. You should also check the log files of your server to see how many people visit your site. Each visit is known as a hit or httpop (http operation). This information is useful to know so that you can upgrade your modem and machine according to your site's growing success.

Now you are set up and your site is hosted. The last issue to confront is maintaining your site once it is online. The final section suggests ways to keep your web site current.

Keeping it Fresh

No web site can remain static. As your business changes, so will your site. With data you gather from visitors and consumers at your site, you will

be obligated to use what you have learned to continuously improve its functionality, efficiency, and simplicity. And to keep customers coming back, you will need to keep you content fresh, your product description current, and you interactive components lively.

Also, to keep your web site content "evergreen" and lessen your maintenance load, follow these guidelines:

- Avoid using phrases that specify or imply dates ("now," "soon," "this summer"). And don't promise content that's "coming soon" or "under construction."
- Name only specific staff members you absolutely must name. People get promotions, change jobs, and sometimes leave the company. Except for people such as press contact and executives, avoid naming specific people on your web site.
- Publish content that is reference-oriented rather than providing users with news.
- Adapt to high-volume holiday and peak shopping periods.
- Adjust your web site to rapidly changing environment and technology.
- Your service and products should be available 24 hours a day, seven days a week.

In general, the more specific, timely, and oriented to the here and now your content is, the more upkeep it will require.

Getting your printing business online can be a fun and satisfying experience for those who design and create their own sites. There are many sites online that can help the printing entrepreneur in every step of the process, found by simply typing in the pertinent information into a search engine.

Starting an e-business is not necessarily dependent upon knowledge of HTML and design for success, however. For those with neither the time nor the inclination to design and build their own sites, the door to having an online business is not closed. There are many firms and individuals available to help business owners design and build their sites, as well as to advise them about ISPs and servers.

The most important thing to remember, whether you create the site yourself or hire someone to do it, is that intensive planning is the key to success. Thoroughly researching what is best for your business and then implementing it will save

money and frustration later on. Following the guidelines listed in this article will help you bring your dream of having an online business to fruition.

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Sandy Goncarovs, Monika Zarzycka, and Aurora Villafranca

Bachelor of Science in Technology candidates

Sandy Goncarovs and Monika Zarzycka are both seniors majoring in Technology Leadership and Supervision and minoring in Graphic Communications Technology at the University of Houston. They will both graduate in August 2001. Monika has been accepted to graduate school and will study Training and Development so that she can work as a teacher/trainer in the printing industry either in the United States or in her native Poland.

Aurora Villafranca is a section majoring in Technology Leadership and Supervision with an area of emphasis in Graphic Communications Technology. Her minor is in Studio Arts/Graphic Communications (Graphic Design). She plans to graduate in Spring 2002.

Page Elements: An Important Aspect of Design

Mengtsung Tai and Charles Johnson
Industrial Technology Department
University of Northern Iowa

When you design a graphic communications product such as a newsletter, you traditionally take into consideration elements of design such as color and lines, as well as principles of design such as balance and unity. However, you also need to consider the page elements for the publication being designed. These are the standard features for different types of publications such as mastheads, captions, and folio lines.

Knowing the page elements helps you in preparing your design as well as communicating the design to others. Let's look at some of the more common features found on news publications such as newsletters.

Identifying Elements

A *nameplate*, also known as a *flag*, is the name of the newsletter as it is shown on the first page. A nameplate conveys the personality of the newsletter and is often the first thing that the reader sees. So, it is the most important identifying element for the newsletter.

The nameplate usually includes an *id line* or *folio line*. This is a line of information which includes the organization or location served (city, school etc.) and the date. Optionally, a volume number might be shown as well as a price.

Masthead is sometimes used synonymously with nameplate, but it is generally agreed that the masthead is different. It is a block of information inside the publication, or on the back, often in a smaller type size, that includes information such as the publisher's name and address, subscription information if any, and editorial staff.

A *folio line* is placed on every page in the publication and often includes the publication name, page number and date. It will be different from the folio line that is part of the nameplate on page one, which typically will not contain a page num-



Page Elements for Newsletters

ber. The folio line beginning on page 2 is usually a header, although a footer could be used as well. By the way, the term *folio* means a page number for a printed piece.

Page One Navigation Elements

A teaser is information on the front page designed to entice or tempt you into reading more inside. Teasers are often boxed and placed at the top of page one.

Another option for page one is an *index* or *contents*, which lists the articles or main sections of the publication, along with page numbers. This information is often placed in a box on the page.

Story Elements

The *headline* is the title for a story. A *kicker* is a lead-in phrase above the headline, and is often

underlined or italicized. A *subhead* is a phrase under the headline. Kickers and subheads are used as needed with the headline, depending on the story. A headline for a main story on a page, that extends all the way across a page, is known as a *banner*.

After the headline, a credit line for the story is used. This is known as a *byline* and provides the author's name.

Text or *body copy* is the content of the story. The lead is the first paragraph of the story and is designed to hook you into continuing with the story. It often contains a summary of the story. One technique for the lead is to think about the 5 W's and H for the story, i.e. who, what, when, where, why, and how.

A *pull quote* or *breakout* is a short quotation that is pulled out of the story to attract attention and possibly entice you to read the story. It is also used to break up long columns of text. A blurb is used in a similar fashion to a pull quote, but does not have to be an exact quote. This gives the writer more freedom if a good quote cannot be found in the article.

If a story is continued to another page, a *jumpline* is used. It contains a page number and optionally, the name of the story. The jumpline appears at both the end of the first part of an article and at the beginning of the second part. The first jumpline indicates on what page the article is continued (e.g. "continued on page 3"). The second jumpline indicates from what page the article is being continued (e.g. "continued from page 1"). If the story title is used as part of the jumpline, it may be shortened to just several words.

Photos and Related Elements

A *photo* is used to add visual interest to your publication. It is one of the most important elements because it captures a reader's attention without saying a word. One type of photo, a *mug shot*, shows someone's face.

A *caption*, also known as a *cutline*, is a description of a photo, often placed underneath or very close to the photo. A *photo credit* may also be used which identifies the source of the photograph, such as the photographer or a wire service (e.g. Associated Press). The photo credit goes on a separate line and is often a smaller type size.

Illustrations are also used in publications. While a photo is an image of the real world, an illustration is drawn. An illustration serves a similar purpose to a photo, i.e. it attracts attention and provides visual interest. *Clip art* collections contain a variety of illustration options.

Rules and Boxes

Rules are simply lines of various widths that are placed on a page. Rules are used to divide elements on the page. They are often used above headlines to divide stories, but have other uses on the page as well.

Boxes are rectangles that may or may not be tinted. Like rules, the purpose is to provide a separation from surrounding elements. An example of a box is a content box that can be placed on page 1 of a newsletter.

Disclaimer

The definitions provided in this article are those that are generally accepted. However, there can be variations in terminology according to the type of publication and even by publisher. So, the definitions provided are meant to be a starting point, not a definitive list. In fact, terminology tends to evolve and change over time, so it is expected that this will be the case with some of these terms as well.

Summary

The best way to see how to effectively use the publication elements discussed is to analyze publications that are similar to the one that you want to create. By studying other designs, you know the element options that are available and how to use them effectively in your design.

Your challenge, starting today, is to analyze each news publication you come in contact with and see how the elements discussed are being used to good advantage to make attractive and functional publications. Enjoy the adventure!

Mengtsung Tai

Master's degree candidate

Mengtsung Tai is a graduate student majoring in Graphic Communications in the Industrial Technology Department at the University of Northern Iowa. Mengtsung will graduate in May 2002.

Charles Johnson

Professor

Dr. Charles D. Johnson is a Professor and Coordinator of Graphic Communications in the Department of Industrial Technology at the University of Northern Iowa.

Wireless Networks

*Veronica Higareda-Pérez for Professor Jerry Waite
Industrial Technology Department
University of Houston*

Two companies which offer wireless network devices are Apple Computer, Inc. and Nortel Networks. Apple provides the Airport Wireless communication that is suitable for small-to-medium businesses, while the Nortel Networks supplies medium-to-large businesses the Reunion Network technology. Apple Airport Wireless technology consists of an Airport Card and a Base Station; in comparison, the Nortel Networks technology uses Quad4 architecture for ATM or IP cell structure transmission. Both products offer wireless technology for organizations; their differences are based on hardware, connectivity, and organization size.

The Airport Wireless Communication consists of two parts, the Airport Card and the Airport Base Station. The Airport Card slides inside a designated slot in the computer. The Airport Base Station connects to the phone line and resembles the function of a cordless telephone base station. It provides an 11-megabit-per-second wireless local area network (LAN) to connect computers to an organization's network and, ultimately, to the internet. The Airport allows users of participating internet companies to simultaneously be connected to the Internet with a single Internet service business account. Participating internet companies include, but are not limited to, Earthlink DSL and EV1 DSL; companies such as AOL (America Online), CompuServe, Warner's Roadrunner DSL, "and any ISP's who run proprietary connections" do not participate (Fusilero, 2000). Warner's Roadrunner DSL is compatible with the technology but each individual must have a separate line/account. AOL is not compatible with the Airport Wireless technology. The Airport technology allows users to be up to 150-feet (50m) radius away from the base station. It allows file sharing, both inside and outside the building, at high speeds without disks or other media. This is critical when businesses must be fast as well as accessi-

ble to compete in today's world. The Airport Base Station uses an RJ-11 connector for built-in 56-Kbps V.90 and an RJ-45 connector for built-in 10Base-T Ethernet connection that allows connection via Ethernet. It can support as many as 450 users at once in a two-square block area (150-feet) with a 2.4 GHz frequency band and 15dBm nominal radio output. This device from Apple uses radio signals to communicate through solid objects, which allows for interoperability with other 802.11-based equipment. Unlike outside computer components such as radio cards and antennas, the Airport Card is the size of a credit card that fits inside the computer's designated slot. The Ethernet alternative enables the network to eliminate the architectural design worry, asbestos, and inflexible wiring configuration. It functions with an existing wired Ethernet network or use a new wireless network. Installation is simple with the product's fully integrated Airport Setup Assistant. A manual installation can be done if desired in lieu of the setup assistant. This software has the ability to a run diagnostics window to help find the best location for the Base Station by demonstrating the noise levels of selected areas. Some of the Airport technology's limitations are, for example, the base station cannot be configured unless an iBook, iMac, or G4 is present. Also, there is one password for the entire network, and some applications do not function if NAT (Network Address Translation) is in use. A DHCP (Dynamic Host Configuration Protocol) or a similar system is necessary because without it the system configuration must be done manually. The system requirements include an Airport-enabled apple computer, minimum 32MB of RAM, and Mac OS 9.0.4 or later. The Airport Card and Airport Base Station are priced at \$99 and \$299 respectively; both may be purchased from the Apple online store, www.apple.com (Sorenson, 2000).

The Reunion Network by Nortel Networks uses a Broadband Wireless Access solution with a design similar to narrowband wireless local loop systems and cell phones. It covers a radius of 2- to 5-km with a connection of 64Kbps to 155Mbps. The high frequency allocation extends from 24 GHz to 38 GHz delivering high-speeds, high-density, along with multimedia services to new and existing clients. The IP or ATM cell structure enables transmissions of "mixed media" such as data, voice, and video using a Quad 4 architecture. The open structure of the Reunion serves from multi-tenant dwellings to large corporations. The Base Station contains a Network Node Equipment (NNE) and Base Station Transceiver (BTR), which are in place to simplify the mapping, modulation, multiplexing, and transmission of multimedia content. The BTR is designed to work with an array of microwave frequencies with a point-to-multi-point method (PMP) that receives and transmits channels upstream as well as downstream. The PMP is separate from the main base station. They are located at the antenna sites and use intermediate frequencies to transmit and receive various types of signals, such as digital. The BTR integrated antenna system is scaled to undertake all weather from -40 degrees C to +55 degrees C with multiple antenna beam widths available. The NNE Customer Premise Equipment is designed for small-to medium-sized business. Features of the NNE include a capacity of 16 sectors per Base Station, in-band software that ensures the system will always be on the leading edge, remote software downloads, modulation agility hot swap servicing, and an integrated SNMP management system. The Reunion Customer Transceiver (CTR) integrated antenna and radio can be mounted outdoors which provides inexpensive waveguides as well as better transmission and reception decreasing power loss. Another component is the Reunion Network Interface Unit (NIU), part of the Quad-4 architecture, which includes Ethernet data services and circuit emulation. This system also comes equipped with a Reunion Management Center (RMC), manages the Reunion Network Elements, Base Station, and CPE, allows the user to monitor and configure the network elements, which include the Fault Management, Security Management, Configuration Management, and

Performance Management. This PMP solution consists of overall features that include decreased entry and deployment costs; demand-based build-out; faster and easier deployment, high efficiency, quality, along with service delivery; and network maintenance, management, and operating cost that are economical. The price of the Reunion Network varies according to system designs and accommodations depending on the size of the organization. The Reunion Network may be purchased online at www.NortelNetworks.com (www.NortelNetworks.com, 2000).

In conclusion, upon research of Apple's Airport Wireless communication and Nortel Networks, the Airport Card and Base Station is suitable for small-to-medium businesses whereas Nortel Reunion Network is suitable for medium-to-large businesses. The Airport Base Station's connectivity design is similar to a cordless telephone base station, while the Reunion Network's design resembles cell phones as well as narrowband wireless local loop systems. The Airport Base Station connects directly to the phone line, the Reunion Network uses a Quad4 architecture for IP or ATM cell structure transmissions. Airport Wireless communication has the ability to support up to 450 users in a 150-foot radius at one time with a 15dBm nominal radio output and a 2.4 GHz frequency band (Sorenson, 2000). In comparison, the Reunion Network's radius extends 2-to-5 km, the connection range is 64Kbps to 155Mbps, and the frequency allocation is 24 GHz to 38 GHz (www.NortelNetworks.com, 2000). The cost for the Airport Wireless communication is \$99 for the Airport Card and \$299 for the Base Station; the Reunion Network's price varies according to organization size and system design.

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Veronica Higareda-Pérez

Bachelor of Science in Technology candidate

Veronica Higareda-Pérez is a junior majoring in Technology Leadership and Supervision with an area of emphasis in Graphic Communications Technology at the University of Houston. She will graduate in December, 2001.

Maximizing Electronic Prepress Efficiency

*Daniel Rodriguez for Professor Jerry Waite
Industrial Technology Department
University of Houston*

Introduction

Keeping a printing press in continual operation is an important factor for a printing company's economic viability. A press, regardless of size or capacity, is a critical production element. Although pressroom activity holds great value for profitability, attention shouldn't be detracted from what occurs earlier in print production. Prepress activity holds great potential for generating quality, technologically superior jobs that may result in customer loyalty and satisfaction.

Printing Industry Trends for Prepress

Many current trends in the printing industry highlight the integral role of electronic prepress operations. One trend, an increasing demand for color, points to the fact that printing in color is less cost-prohibitive today than it was 15-20 years ago. Full-color jobs, such as brochures and annual reports, send a message about a company's viability. Utilizing such graphic software as Photoshop and Illustrator, sharp graphics can be created that maximize the impact of color, and reinforce the message of company viability.

Another trend that warrants investment in a good electronic prepress department is the rise of customization and personalization. Companies that utilize direct-mail marketing, for example, know the value of a printed item that will draw a prospect's attention. Advances in digital press technology are facilitating an increase in personalization. A well-functioning prepress department's activity can interact with pressroom activity to capitalize on such technological advances.

The Growing Role of Electronic Prepress

Sales growth and expectations in the first quarter of the year 2000 for the printing industry emphasize the expanding role of electronic prepress services. The average percent change year-to-date for the first quarter of 2000 versus the first quarter of 1999 was +8.7%, according to Ron Davis and Steve Kodey of the Printing Industries of America. Furthermore, the expected percent change for the next twelve months for this category is an impressive +10.4%. The next-closest percentage leap for this time period occurred for direct mail, underlining again the strong trend toward personalization.

Bearing the above trends and statistics in mind, it becomes clear that advancements or innovations that maximize the efficiency of electronic prepress workflow is beneficial. The issue at hand is how to decide which methods are best for facilitating an increase in efficiency.

Reducing Design-Related Problems

A good starting point is fostering graphic design decisions that will reduce imagesetting problems, such as those likely to occur with trapping and color separations. Carol Littleton, at Braden Printing, Inc. in Keene, New Hampshire, provides some basic considerations to graphic designers on the printer's perspective on her company's website, at www.bradenprint.com. Her tips are beneficial for those who may specialize only in the design of printed products. One good example is her elaboration of using font "styles" on a Mac platform. Littleton targets potential problems caused by using the bold, underline, italic, shadow, and other "style" buttons when it comes time to imageset. For example, imagesetters at times cannot replace stylized text with the actual PostScript version of those styles. Littleton recommends

recreating such effects manually, as with her example of creating drop shadow by copying the type, making it a tint of the color, and offsetting it manually. This option is beneficial for designers who, for some reason, don't want to use an actual PostScript font, even though such fonts are less problematic.

Such basic tips to graphic designers could benefit the electronic prepress department, which can bypass design-related problems while preparing a job to be sent to the press. The result is a decrease in imagesetting time. This will facilitate a shortened deadline and increase customer satisfaction.

Targeting design-related problems is not, however, a cure-all for an electronic prepress department. Other electronic prepress activities can create delays that hinder pressroom activity and, therefore, profitability. One example is the length of time it takes for an image to rasterize, which can create a delay of several minutes. Two examples of reducing such delays are implementation of task automation, as well as investment in current technology.

Task Automation

Task automation enables prepress workers to send a job to the press at a faster rate. Charles M. Pickett illustrates such automation techniques on the National Association for Printing Leadership website, www.napl.org. Pickett notes that automating small tasks is a logical way to start. One example is scripting various desktop publishing applications to launch with the touch of a single key, like F1. This saves the individual from having to launch different applications separately at the start of the workday. Another example is simplifying common functions in such applications as Photoshop. For example, instead of selecting Image>Mode>CMYK Color, actions can be assigned to function keys. F3 could open the Image Size dialog box; F5 could select the Unsharp Mask. This would eliminate valuable time wasted on guiding the mouse through different menus.

Pickett admits that a "steep learning curve" exists with regard to employing scripts with AppleScript for Visual Basic. He recommends the alternative of hiring an experienced programmer familiar with prepress software to accomplish this automation.

Investment in Current Technology

Another important, albeit costly, way to speeding-up electronic prepress workflow is investing in new technology that will target elements of prepress production that have always caused delays. A technology that surfaced in 1998 is the Panther PageTrapper option for the Adobe PostScript 3-based Panther RIP. The Panther PageTrapper makes it possible for printers to trap and RIP their pages all in one step. Mike Dillon, Senior Vice President of Sales and Marketing for PrePRESS (which manufactures the Panther RIP) states that this combination "...delivers tight deadline control with the highest levels of productivity." Capitalizing on technological advances such as the Panther PageTrapper will undoubtedly facilitate smoother progress towards meeting such deadlines.

Although new technology accelerates workflow, it involves the investment of capital. A cost-benefit analysis needs to be made before acquiring new technology. Factors such as compatibility with other software and hardware, time to train employees to use the new equipment, and overall cost need to be taken into account. In addition, managers must know what alternative solutions may exist.

Streamlining Prepress Activity

Investing in new technology is an obvious solution to accelerating workflow. However, it is important to note that with some ingenuity other solutions can be implemented that will improve current methods of prepress workflow without totally replacing existing equipment and knowledge. Terry Hillock of Marrs Printing in California did just that during his first two years with the company. His story can be found at the company website, www.marrs.com. Hillock arrived there to find seven Macintoshes and one Sun SPARCstation networked in peer-to-peer fashion using Apple file sharing over 10Base2 (Thin Ethernet) wiring. Each workstation acted as a server, and made certain files available to everyone else on the network. At the time, the business was growing at about 15 percent a year, and increasingly complex graphics applications generated larger files. This strained Marrs' production system and

overloaded the RIP during the crunch times. It became difficult to track various revisions of file images from workstation to workstation. This resulted in mistakes. Furthermore, the peer-to-peer file-sharing tied up the Macs transferring files to the Sun RIP. Along with other problems, Marrs was losing two to three hours of production time per shift spent archiving and recovering files. Hillock and others in the company decided to convert from peer-to-peer file sharing to a centralized file server, where jobs could be organized and kept. This decision saved Marrs Printing valuable time lost in prepress.

Conclusion

Several methods for accelerating workflow exist for each printing company. Current printing industry trends such as an increase of color usage, emphasis on personalization, an increase in automated processes, and shorter deadlines demand that a printing company research and implement solutions to existing problems and characteristics that decrease workflow. Though such solutions apply to each level of production, improvements in the increasingly important (and profitable) prepress department will strongly aid a printer in being both competitive and economically viable in the long run.

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Daniel Rodriguez

Bachelor of Science in Technology candidate

Daniel Rodriguez is a senior majoring in Technology Leadership and Supervision with an area of emphasis in Graphic Communications Technology and minoring in Mexican-American Studies. He will graduate in May, 2003.

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