Print...the Global Language

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Visual Communications Journal

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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 authors and do not necessarily reflect the policy or the views of the IGAEA.

Article Submission
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Membership and Subscription Information
Information about membership in the Association or subscription to the Journal should be directed to IGAEA Second Vice-President.

Editor's Note

Readers of this year's Visual Communications Journal can expect a variety of interesting articles. Staying abreast of technological developments is paramount to the delivery of quality graphic communication programs and several of the articles address applications of current technologies such as variable data printing, Portable Document Format (PDF), digital imaging, and cross-media publishing. You can also look forward to reading about recent research, curricular, as well as extra-curricular, issues and experimenting with technical "how-to" articles. Additionally, there are three very good student articles included in this year's issue.

Overall, the authors have provided some very useful and timely information to their profession. Please join me in thanking, and congratulating, those individuals whose articles were accepted for publication in the 2004 Visual Communications Journal.

In this Issue

Among the refereed articles, Dean Gilbert and John Leininger report the results of a study designed to analyze the benefits of using variable data printing for direct-mail advertising. In his article, Andrew Anderson determines the nature and extent to which new-media technologies are currently reflected in four-year graphic communication programs. Devang Mehta describes the findings of his research on how commercial printing firms that use business-to-customer web operations perform in categories such as number of customers, merchandise return rates and sales and marketing productivity. Dan Wilson and Karen Murray provide the feedback they received from a statewide needs-assessment in Pennsylvania that sought the answers to six specific questions of interest to graphic communication educators. Another survey by John Craft and Tom Spotts sought opinions from graphics professionals regarding he prevalence of cross-media publication and the resulting implications for educators. And, Gene Van Roy wanted to know: what preparation do graphic design students need to be successful when designing products for commercial printing? His project employed an industry focus group and surveys of commercial printing Prepress Managers and Art Directors from advertising agencies to determine the answer to that question.

The two juried articles relate to the implementation of technical methods. Thomas Tyberg discusses the pros and cons of PDF and offered some recommendations and guidelines for PDF usage. Klaus Schmidt and Dan Wilson present three different curricular scenarios for integrating Applescript into graphic communication programs.

There are four edited articles this year. Judy Birchman describes how to use images effectively in page design and gives examples to illustrate her point. Milos Krsmanovic explains the popularity of PDF files and how they can be used for cross-media publications. Lesta Burgess describes the role of faculty advisors of student organizations and makes suggestions for activities and maintaining participation. And, Chris Lantz debates the trend in photography towards digital photography and details the types of digital cameras that are now available.

Three student articles were published in this issue. Megan Chase, a graduate of the Masters in Graphic Communication from Clemson University, authored a report on her research to compare digital flexographic plates types. From the University of Houston, Jaime Rios, Tanya Morkovsky, and Raymond Hatler describe different methods and reasons for network security in graphic communications. Finally, Ryan Cross, from Illinois State University, wrote on the topic of Job Definition Format (JDF) as a new workflow standard for the printing industry.

Thank you

The jurors this year were John Craft, Penny Ann Dolin, Lee Weir, Charles Weiss and Dan Wilson. Each juror received approximately seven manuscripts to review in one month, so they should definitely be recognized for their contribution.

Thanks to Charles Johnson, VCJ editor from 2002-2003, for forwarding information and advice on handling the role of editor.

I owe a huge debt of gratitude to my colleague, Dr. Eric Weisenmiller, for his efforts as Assistant Editor. Eric managed the layout and design for the journal and helped review manuscripts as they were submitted. Eric's past experience as a juror for the VCJ was invaluable.

Thanks also to the IGAEA executive board, and the members, for entrusting me with the responsibility of editing the Journal. It was an honor to serve the Association in this manner.

Respectfully,

Mark Snyder, Editor
Visual Communications Journal 2004

Graphic Communications Curriculum: A Study of Courses Containing New Media Content

Andrew L. Anderson, Ph.D.

Introduction

A recent article (Hevenor, 2002) noted that Roger Hill's Associates, a self-described leading digital printing advisory and product development firm in Marshfield, Massachusetts, had announced a "speaking sign kit" for the wide-format print market. The kit being described included a lightweight, thin speaker that is placed inside or on the back of a frame or artwork that holds a digitally printed message. When a potential viewer approaches the sign, a light-activated sensor starts the digital voice recorder for playback of a message or audio track up to 20 seconds in length.

The Electronic Document Systems Foundation (Romano, 2003) reported that several universities have begun to distribute student resource materials – textbooks, manuals, lecture slides – in electronic form. One example was a dental school that would replace 2 million pages, thousands of images, and over 400 pounds of books and manuals with a single DVD.

The sales of e-books during the third quarter of 2003 have increased by 64% over the same period from last year (Open eBook Forum, 2003). During the same time period, the total number of e-Books published increased by 74%.

Literally thousands of examples could be used to provide evidence that means by which we use media to disseminate information are both varied and changing. Such examples would further illustrate the dynamic ways in which we create, disseminate, and receive information. The challenge for educators is to determine how best to respond to the changes that are occurring in terms of curriculum and course content. The challenge is especially relevant for institutions that work with media in the form of offering traditional printing, graphics arts, or related degree programs. Not only are they faced with the need to respond to new media technologies, they must also sort through the often conflicting reports of the current and future growth/decline of printing.

Review of the Literature

The boundaries that define the various media are becoming less clear as the content, tools, and workflow are increasingly shared and integrated. One need only to look at the functionality associated with word processing software. While developed to prepare printed documents, word processors are now equally adept at integrating graphics, producing PDF files, and exporting HTML code for web pages. Terms such as holistic communications (Surprise, 2003), cross-media publishing (Romano, 2001), and repurposing content provide evidence of the changing nature of industry. All the previous terms address a different approach to traditional client relationships and production workflow.

Such trends are also driven by various "new" media technologies that have some relationship to graphic arts or printing programs that currently exist at many academic institutions. In his research monograph The Generation Beyond Print-on-Paper, Kleper (2002) concludes the "development of new display technologies which resemble print on paper suggests both a significant challenge to, and a difficult-to-realize opportunity for, the printing industry. Printers must begin to think of themselves not as printers, but as display-makers. A new industry of display-makers is arising, and it will be difficult to compete with them."

The question is how new approaches to media and their associated technologies should be reflected in academic programs and what relationship they may have with existing programs that have traditionally placed a heavy emphasis on print media. Burgess, Hall, and Varzavand (2001) posed the question of what role and/or function graphic communications graduates will have in a growing and evolving digital marketplace. Does that role require a more "holistic" approach to the study of communications? Can academic programs expand to cover a wider range of media and still provide graduates with enough knowledge of the rapidly changing print workflow and its associated processes? While programs may be exploring new media technologies, there is some evidence that the number of graduates of printing-related programs is not currently adequate to meet existing demand (Hevenor, 2002). At the same time, the printing industry is faced with a reduction in labor-intensive processes, automation, and the loss of some levels of print to electronic methods (Romano, 2002).

The International Graphic Arts Education Association (1999) uses the following 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. GC 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.

The definition goes on to further describe technology-based systems as comprising "the evolving technologies of computer age prepress, image generation, data repurposing, designing and posting to internet web pages, interactive multimedia, digital photography, electronic digital imaging, and desktop publishing."

Strategic planning is described as a disciplined effort to produce fundamental decisions and actions that shape and guide what an organization is, what it does, and why (Bryson, 1995). In excerpts from its Creative Market: Canaries in the Mine Shaft report (2003), TrendWatch Graphic Arts indicated such planning was evident in "… firms that are retooling, restructuring, and redirecting their businesses in light of the changing economic, business and graphic communications environment." Steven Snoll, president of Snoll Media Consulting, in a recent article on future trends, was even more specific when he stated: "To stay competitive, the savvy business leader must understand the need to deliver world-class content through any means: print, Internet, and wireless" (Joss, 2003).

Adjusting to change and determining appropriate content is an ongoing process in education. Faoli (1999) noted "technology trends and innovations have caused the GC industry to contend with an array of new problems. Technology has produced progress, controlled order, efficiency, and measured success, but it has also estranged many in the GC Industry who are struggling to adapt to its advances. As we proceed into the next millennium, it is critical that GC educators address a broad range of important issues brought about by technology." Hao (2003) observed in a study of course content that many content areas identified as important for graphic communications programs related to newer technologies. He further concluded that this was both a reflection of the changes occurring in the industry and perhaps a reflection of student interest.

Driven by the changes in the industry, demands of the market (employers and students), and finite resources, educators must strategically determine direction. While a broader, more multimedia approach may be attractive to a wider population of students and employers, it is often a challenge to implement a curriculum that reflects that approach in a meaningful way without diminishing the capacity to deliver quality in existing programs – i.e. print.

Interestingly, a much more broad-based approach to communication was presented as part of *A Curriculum to Reflect Technology* at the 1947 American Industrial Arts Association conference (Phillips and Lefor, 2002). Divided into several content areas, the curriculum outline suggested for the communications division included:

Composition & Duplication
Graphic Arts —Sound Recording
Drawing, Sketching
Drafting, Blueprinting
Letterpress
Photography
Intagliography
Planography
Duplicating
Sound Recording
Transmission & Reception
Mechanical-Electrical
Telegraphy
Telephone
Radio (CD, MOD)
Teletype
Facsimile
Television
Multi-Channel Methods
Radar
Interpretation
Visual, Sound, and Codes
Historical
Signal Flags
Lights
Sound Devices

This list above raises the question if such a broad-based curriculum designed to meet the needs of general education is also appropriate for programs primarily focused on preparing qualified graduates to enter industry. It also raises the issue with regard to the ability of academic departments to acquire and sustain the resources needed to deliver such a broad array of content.

The Study

The purpose of the study was to determine the nature and extent to which new media technologies are reflected in courses offered at four-year colleges and universities. The intent was that the results of the assessment provide useful information as part of a strategic process of determining how best to reflect new media content into the curriculum of a program primarily focused on print media.

The subjects of the inquiry were select faculty and institutions with membership in the National Association of Industrial Technology (NAIT). The membership of NAIT is used because it reflects the accreditation of many college and university programs offering related programs. Two different approaches were used in determining scope and extent to which new media is currently reflected in programs and courses. The first approach was the use of an email survey sent to faculty to assess programmatic issues. The second approach was a content analysis of university catalogs to determine the extent to which new media content was reflected in individual course

descriptions.

Email Survey

The survey population was selected from a list of faculty provided in the National Association of Industrial Technology 2003 Baccalaureate Program Directory (2003). Faculty were selected from the membership if their listed program area included one or more of the following terms: communications, computer-aided design, design, desktop publishing, graphic arts, graphics, information technology, printing, publishing, or telecommunications.

This resulted in an initial list of 233 names, with 223 listing an email address. The list was sorted to remove duplicate institutions. When an institution had more than one faculty member, an individual was selected based first on position (chair, director, or coordinator), then faculty rank (professor, associate professor, etc.), followed by highest degree (doctorate, masters, baccalaureate). If duplicates remained, the final selection was random. Removing duplicates resulted in a final list of 70 faculty from different institutions.

An email was sent to the 70 faculty requesting they complete an online survey. A follow-up email was sent 10 days after the first email. A total of 27 (38.6%) responded by completing the online survey instrument.

The first question asked the name of the department in which the faculty member resided. The responses were:

- Applied Science
- Aviation and Technology
- Business Education/Organizational Systems Technology
- Computer Electronics and Graphics Technology
- Education
- Engineering Technology
- Graphic Communication Systems and Technological Studies
- Graphic Communications Management
- Graphic Imaging and Design Technology
- Graphics and Imaging Technologies
- Industrial & Engineering Technology
- Industrial Technology (3)
- Information and Logistics Technology Department
- Occupational & Technical Studies
- Printing & Digital Imaging Management
- Printing and Imaging Technology Management
- Technological Studies
- Technology (7)
- Technology and Applied Sciences

Question two asked if the department in which they resided offered courses in graphic arts, printing, or similar topics that relate primarily to print media. Twenty (74.1%) of the respondents indicated they offered such courses. Six (22.2%) indicated they did not offer such courses and one (3.7%) survey had no response.

A list of new media technology topics was established and used to determine if they were being taught at the surveyed institutions. Question 3 asked if the department in which the faculty member resided offered course(s) in which a major emphasis related to learning about one of the new media topics. The topics included:

- Web design, preparation, and/or production
- Video design, preparation, and/or production
- Audio design, preparation, and/or production
- CD-ROM design, authoring, and/or production
- DVD design, authoring, and/or production
- CAD rendering
- Animation design, preparation, and/or production

The results indicated a number of programs offering courses in the various topic areas.

Over half (59.3%) of the respondents indicated they offered at least one course with a major emphasis in the areas of web design, preparation, and/or production and CAD rendering. Only two (7.4%) respondents indicated they offered courses with a major emphasis in audio design, preparation, and/or production.

Question 4 asked those that responded to any of the items in question 3, to indicate the impact of the new media offerings on their graphic arts, printing, or related print media courses.

Table 1. Total number and percentage of respondents (N=27) offering courses with a major emphasis in new media topics.

	Web	Video	Audio	CD-ROM	DVD	CAD Rendering	Animation
Yes	16 (59.3%)	9 (33.3%)	2 (7.4%)	9 (33.3%)	3 (11.1%)	16 (59.3%)	8 (29.6%)
No	11 (40.7%)	18 (66.7%)	25 (92.6%)	18 (66.7%)	24 (88.9%)	11 (40.7%)	19 (70.4%)

Approximately one-half (51.9%) of all those surveyed indicated the courses had no significant impact on print-related courses. That number and others may actually be higher since only 20 of the 27 indicated they offered

Response	*n*	*Percent*
no response	2	7.4%
Department does not offer courses in graphic arts, printing, or similar topics that relate primarily to print media	3	11.1%
No significant impact on print-related courses	14	51.9%
Resulted in a decrease in the number of print-related courses	1	3.7%
Resulted in an increase in the number of print-related courses	3	11.1%
Don't know	3	11.1%

Table 2. Total number and percentage of respondents (N=27) indicating impact on graphic arts, printing, or similar courses.

courses in graphic arts, printing, or similar topics that relate primarily to print media. Only one (3.7%) of the respondents indicated the new media offering(s) resulted in a decrease in the number of print-related courses. Three (11.1%) indicated the offering(s) resulted in an increase in the number of print-related courses.

Question 5 sought to determine future directions with regard to the selected new media content areas. They were asked to respond to the areas in terms of four responses: plan to expand instruction, plan to reduce instruction, don't know, and no change.

Response	*Web*	*Video*	*Audio*	*CD-ROM*	*DVD*	*CAD Rendering*	*Animation*
no response	3 (11.1%)	5 (18.5%)	7 (25.9%)	5 (18.5%)	7 (25.9%)	5 (18.5%)	7 (25.9%)
Plan to expand instruction	12 (44.4%)	9 (33.3%)	5 (18.5%)	7 (25.9%)	8 (29.6%)	9 (33.3%)	10 (37.0%)
Plan to reduce instruction	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Don't know	1 (3.7%)	2 (7.4%)	4 (14.8%)	4 (14.8%)	4 (14.8%)	3 (11.1%)	2 (7.4%)
No Change	11 (40.7%)	11 (40.7%)	11 (40.7%)	11 (40.7%)	8 (29.6%)	10 (37.0%)	8 (29.6%)

Table 3. Total number and percentage of respondents (N=27) indicating future directions with regard to selected new media content areas.

None of the respondents indicated they planned to reduce instruction related to any of the topic areas. While many indicated they planned no change, 44.4% of the respondents indicated they planned to expand instruction in the area of web content. This was the highest percentage in spite of the fact that 59.3% of the respondents currently were teaching courses in the area of web design, preparation, and/or production.

Question 6 asked if the respondents had any comments regarding "new media" courses and their relation to graphic arts, printing, or courses offering similar topics that relate primarily to print media? There were several responses recognizing that some printing programs are offering new media courses or changing their emphasis to include more new media content. The comments received for question 6 can be summarized in terms of several major themes.

- Respondents' concern that programs are expanding to incorporate different media and emphasizing only prepress aspects of printing with little sense of the market for such graduates.
- Individuals thought new media content compliments traditional printing courses and can serve as a vehicle to recruit students into degree programs and increase enrollment.
- With the demand for new media courses and degrees, there is a concern that other academic departments will undertake competing programs to meet the need. In some cases, other departments already have such programs.

Content Analysis

A content analysis was undertaken of selected college catalogs to determine the extent to which the new media was reflected in course descriptions and to determine which other departments were also teaching new media content. Ippolito (1995) found the content analysis methodology effective in examining the prevalence of electronic imaging technology courses in post-secondary image arts and arts education programs. The methodology is further enhanced by the availability of on-line access to college and university undergraduate catalogs.

The content analysis included a review of course catalogs from a list of institutions selected from the same initial population used in the email survey. From the list of 70 institutions, one-half (35) were randomly selected for review of their respective undergraduate catalog. Course descriptions from the department in which the selected faculty member resided and those from other departments were reviewed for the 35 schools. The catalogs reviewed were in the form of PDF (portable document format) files available from College Source Online (2003). Each catalog was searched using a list of keywords to determine if course description(s) existed that included the keyword. The descriptions were then reviewed to determine if course content pertained to learning about the keyword rather than its use for course delivery. The keywords searched included: digital media (actual search was "digital" and "media"), multimedia, authoring, web, video, audio, animation, CD-ROM (actual search was "CD" and "ROM"), DVD, and CAD rendering (actual search was "rendering").

The review identified the number of course descriptions

for each keyword that existed in the department from which the faculty member in the initial population resided. In addition, a list of other departments that had course descriptions containing the keyword was made for each of the schools. The range of total course descriptions containing one of the keywords within the faculty member's department was 0 to 6. The list of other departments includes several specific department names that have been combined. For example, several departments with specific names in the area of education are all listed under the title of education.

For the department in which the faculty member teaches, the following table provides the number of course descriptions that included the searched keyword.

	Digital Media		*Multimedia*		*Authoring*		*Web*	
No. of Courses	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
0	31	88.57%	22	62.86%	30	85.71%	21	60.00%
1	3	8.57%	5	14.29%	3	8.57%	7	20.00%
2	0	0.00%	4	11.43%	1	2.86%	3	8.57%
3	0	0.00%	3	8.57%	1	2.86%	1	2.86%
4	0	0.00%	1	2.86%	0	0.00%	2	5.71%
5	0	0.00%	0	0.00%	0	0.00%	0	0.00%
6	1	2.86%	0	0.00%	0	0.00%	1	2.86%

Table 4. Number of course descriptions that contain the keywords digital media, multimedia, authoring, and web.

Course descriptions in several of the surveyed departments included content in digital media, multimedia, authoring, and web. Web was the most common with 14 of the 35 (40%) departments in which the faculty member resides offering courses with an emphasis in that area.

The topics of multimedia and web were most frequently found in the course descriptions of departments other than the one in which the faculty member resides. The topic of multimedia was found to exist in the course description of 55 departments with education (25.45%) and computer science (18.18%) being the most frequent. While authoring (15) and digital media (13) had relatively low frequencies, the topic of web had the largest number of departments (70) with course descriptions in that area. Web content in course descriptions most frequently appeared in departments of business (15.71%), education (14.29%), communications (12.86%), computer science (12.86%), and art (11.43%).

Table 5. Number of course descriptions that contain the keywords video, audio, animation, and CD-ROM or DVD.

Faculty reported few programs had courses covering audio (11.43%) and CD/DVD production (8.57%). Course descriptions that included video (22.86%) and animation (31.43%) were higher. Video (71), audio (51), and animation (40) were frequently taught in other departments. Video showing the highest frequency of all the topics analyzed with the topics most frequently found in communications programs (25.35%). Audio content also appeared most frequently in communications (31.37%). Animation was found to exist most frequently in art (27.5%) programs.

	Video		*Audio*		*Animation*		*CD/DVD*	
No. of Courses	***n***	***%***	***n***	***%***	***n***	***%***	***N***	***%***
0	27	77.14%	31	88.57%	23	65.71%	32	91.43%
1	5	14.29%	4	11.43%	8	22.86%	3	8.57%
2	2	5.71%	0	0.00%	3	8.57%	0	0.00%
3	1	2.86%	0	0.00%	0	0.00%	0	0.00%
4	0	0.00%	0	0.00%	0	0.00%	0	0.00%
5	0	0.00%	0	0.00%	0	0.00%	0	0.00%
6	0	0.00%	0	0.00%	1	2.86%	0	0.00%

Table 5. Number of course descriptions that contain the keywords video, audio, animation, and CD-ROM or DVD.

Of the population analyzed, CAD rendering appeared in the course descriptions of 13 (37.14%) of the programs. Twenty-four other programs at the respondents' intitutions also had courses with emphasis on CAD rendering with architecture and computer science being the most frequent (20.83%).

Conclusions and Discussion

Academic programs are expanding to incorporate content in media areas other than print. The definition of graphic communications approved by the International Graphic Arts Education Association recognizes "the evolving technologies" that are evident in image generation and publishing. There is also evidence that the expansion of such instruction will continue.

	Rendering	
No. of Courses	***n***	***%***
0	22	62.86%
1	11	31.43%
2	2	5.71%
3	0	0.00%
4	0	0.00%
5	0	0.00%
6	0	0.00%

Table 6. Number of course descriptions that contain the keyword rendering.

There remains the need to further study the curriculum in terms of how it should best reflect the new media technologies in terms of course content and curriculum. There is little doubt there is a demand for new media courses and that students are highly motivated by the content. Hao (2003) concluded that the integration of new technology may be partially driven by student interest. This was also supported by the comments from respondents of this study.

There are many other aspects to consider in terms of expanding academic offerings, including acquiring and maintaining faculty expertise, resource availability,

equipment maintenance and support, and evidence of programmatic need. While printing has historically offered a reasonably well-defined content universe, new media has made determining appropriate content much more of a challenge. A fitting conclusion to this study is Failo's (1999) statement that "the strategy of remarketing and reshaping a GC program image is necessary for every school that is serious about meeting the challenge of the newer and ever-advancing trends of graphic technology."

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The Benefits of Variable Data Printing: A Cost-per-response Analysis of Direct Mail Advertising

E. Dean Gilbert, Ed.D. and John Leininger, Ed.D.

Introduction

Existing studies dealing with personalized one to one mailings using variable data tied to today's new digital color printing devices, boast of shifts in customer response rates from 2% to over 400% (Granger, 2001). In these studies there are no controlled elements to compare results on an analytical level. There is little research evidence analyzing the effectiveness of variable data printing on customer response rates. A review of literature found no evidence of any controlled statistical study that examined the effect of various levels of variable data on cost-per-response in direct mail printing. While a number of printing companies, trade associations and several academic institutions had studied the effects of using variable data to personalize the text and graphics in marketing campaigns; most of these studies were designed to compare the results of the mailings to national averages. Some of the studies were set up to compare mailings between a static mailing piece and a piece that had both variable text and variable graphics (Broudy & Romano, 1999). The level of variable text and variable graphics was used to make the viewer feel the message was personalized to them. The single biggest limiting factor of these studies was the lack of statistical analysis. Virtually all of the case studies compared percentages of returns on the mailings. Unfortunately such percentages are subject to viewer bias and the increases in percentage may not offset the increased cost associated with the design and prepress production.

When people report percentage changes they can make the differences seem significant when there really may not actually be that big of a difference. If the percentage of returned responses grows from 1% to 2% certain companies will report this as a 200% increase in the response. Answers to the following questions can provide far more usable reporting. What was the cost to raise the percentage from 1 to 2%? What would it cost to change it from 2 to 10%? Is it worth the increased cost of the design and computer work for preparing the database to trigger the proper selection of the variable text block and proper selection of the graphic images? Was the cost of securing the additional photos and graphic images balanced by the increased response? These are issues that cannot be interpreted from a group of percentages or even by comparing the dollars earned by responses from one company. There needs to be control and experimental elements designed into a study that creates a data group that can be analyzed with acceptable statistical tools to determine significance without interpretation. This need for sound statistical research was the driving force for outlining a study that would validate the assumptions made from previous studies.

Outlining the Conditions of the Study

The study was designed to identify not only the level of response from a variable data mailing versus a static mailing, but it was designed to look at the difference between different levels of variable data printing. Specifically, the format was created to compare two different forms of variable data printing; one with variable text only and one printed with variable text and variable graphics. Additionally, the cost-per-response was calculated and compared between the different levels of mailings. Finally the value of the customer's response was also brought into the scope of the study.

Once the outline for the study was developed a partnership was established with a medium-sized printer in the southeast wanting to enhance its ability to work in the variable data personalized print market. This printer had been using digital printing equipment for over two years and was already involved with variable data for industrial and athletic printing markets. They were looking to develop their own successful case studies to show their customers the value of VDP. They agreed to work with the researcher to identify potential customers who appeared to be proper candidates for the variable data study. They were even willing to reduce the price of the printing to these customers in an effort to help offset the increased design costs that would be incurred by participating in the study. The costs would still be calculated based on the normal estimated price, not the special price, when used in the analysis of the data.

All of the elements for the study were available in August and a committee of peers reviewed the methodology. The committee was comprised of four Clemson University faculty including one with 27 years experience in teaching and working within the printing industry, one with 35 years experience teaching statistics, one from the marketing department and one with a background in training and development of academic research. Once the procedure was outlined and planned, the researcher began to work with the printer to identify different customers who would be both willing and had the proper need for pursuing a variable data printed piece.

To be accepted as a participating company in the study they had to agree to allow the mailing to be randomly divided into three different levels of variable data.

The three levels of variable data were equally and randomly divided from the total mailing. The minimum requirements for each level were presented to the customers and they had to agree to modify the printed piece for the three levels of design. Each group would have to have a method of identification, such as: a code, graphic, or substrate selection assigning credit for the returned responses from the mailing recipients to the appropriate category.

Level #1: The Static Control Group—one third of the mailing records randomly selected prior to the merging of the variable information with default (no variable data) text and graphics used.

Level #2: The Variable Text Group—one third of the mailing records randomly selected prior to the merging of the variable information and only the variable text is changed on the front and back of the VDP piece.

Level #3: The Full Variable Group—one third of the mailing records randomly selected prior to merging of the variable information. This group would have both variable text and variable graphics. For inclusion in the study the printed piece had to have at least one text block and two graphic images changing on each side of the sheet.

Eight customers were identified to be included in the study. They were presented the requirements for the printed piece. The original goal was to identify four companies from different industries; the additional participants were identified to allow for attrition in the study. If the customer's final printed piece did not conform to the three specified levels it could not be included in the study. Four of the eight customers were dropped; two for the designer's failure to work within the design requirements of the different levels, one due to the printer's data preparation not accurately dividing the recipients into the three assigned groups and randomly selecting the members of each group. The fourth for failure to meet the customer's delivery deadline. The results of the study were based on the four completed mailings to evaluate the relationship of the percentage of responses for each level, the relationship to the cost per response for each level of mailing, and the perceived value of a response as determined by the customer.

The raw data of the four mailings that properly satisfied the requirements to be included in the study are listed in the table below.

There were three specific questions addressed: (1) Was there a significant difference between the static and variable data with respects to the number of responses? (2) Was there a significant difference between the cost per response for the static and variable data? (3) Was the value of the response, as identified by the individual company, supportive of the increased cost for the variable data?

Testing of Hypotheses

Research Hypothesis 1: *A higher degree of variable data will produce a higher customer response rate.*

Hypothesis 1 sought to provide evidence that with a higher level of variable data comes an elevated level of response. A random blocks design analysis of variance (ANOVA) was used to analyze the data. A base assumption of the ANOVA statistical test is the homogeneity of variance. The collected data, however, had great variability of response rates between client companies. Three of the client companies had response rates of 1—2% and the national retailer had response rates in excess of 60%. This large variability among response rates skews the distribution and, unless addressed, would

	Variable Data Project #1			Variable Data Project #2			Variable Data Project #3			Variable Data Project #4		
	Group 1: Static Default Printed Piece	**Group 2:** Variable Text Only	**Group 3:** Variable Text and Variable Graphics	**Group 1:** Static Default Printed Piece	**Group 2:** Variable Text Only	**Group 3:** Variable Text and Variable Graphics	**Group 1:** Static Default Printed Piece	**Group 2:** Variable Text Only	**Group 3:** Variable Text and Variable Graphics	**Group 1:** Static Default Printed Piece	**Group 2:** Variable Text Only	**Group 3:** Variable Text and Variable Graphics
Type of company the VDP piece was done for	Custom Screen Printer	Custom Screen Printer	Custom Screen Printer	National Retailer	National Retailer	National Retailer	Fund Raising Foundation	Fund Raising Foundation	Fund Raising Foundation	Bank	Bank	Bank
Total count of the VDP piece: (This will be the same for each group)	2,100	2,100	2,100	15,101	15,101	15,101	18,111	18,111	18,111	8,958	8,958	8,958
Number of records separated for study: (it should typically be 100 or more)	700	700	700	5000	5111	4990	6,037	6,037	6,037	2,986	2,986	2,986
Cost of design for the entire job for each Group #:	$475.00	$580.00	$760.00	$5,000.00	$10,000.00	$15,000.00	$625.00	$700.00	$900.00	$916.67	$916.67	$1,966.67
Cost of printing the entire job for each Group #:	$1,216.00	$1,338.00	$2,197.00	$5,288.00	$5,966.00	$8,638.00	$3,473.00	$3,881.00	$7,607.00	$2,166.00	$2,696.00	$5,129.00
Responses per Group #:	6	14	23	3130	3444	3348	80	89	136	24	32	46
Customer's percieved value for a response: This will typically be the same for each Group #	$800.00	$800.00	$800.00	$524.05	$524.05	$524.05	$41.35	$41.35	$41.35	$9.55	$9.55	$9.55
Percent Response:	0.86%	2.00%	3.29%	62.60%	67.38%	67.09%	1.33%	1.47%	2.25%	0.80%	1.07%	1.54%
Cost per response:	$281.83	$137.00	$128.57	$3.29	$4.64	$7.06	$51.23	$51.47	$62.55	$128.44	$112.90	$154.25

Table 1–Response Data

result in an inaccurate analysis. A solution is to perform a log transformation in which the natural logs of the values of the variable are used, rather than the original raw values (Keller & Warrack, 2000). After normalizing the variability of the data utilizing this procedure the ANOVA was calculated using the log of the raw data. The ANOVA ($p < .05$) allowed the rejection of the null hypothesis and acceptance of the hypothesis—revealing a significant difference in rate of response when elevated levels of variable data were introduced. Figure 1 shows the means of raw percentage of response data for each level, which is provided as a visual below.

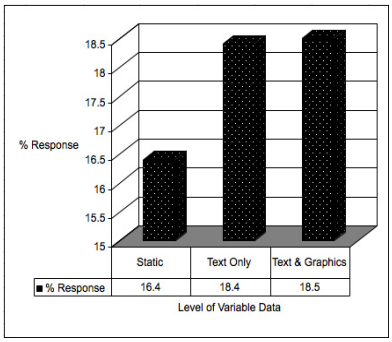

Figure 1. The means of the response rate (percentage)

Research Hypothesis 2: Variable data cost-per-response is lower than conventionally printed direct mailing cost-per-response.

Hypothesis 2 sought to establish that a decline in cost-per-response occurred when the level of variable data increased in mass mailing advertising. There are three basic costs involved in the calculation of data for this study: design cost which was supplied by the client company, and printing and mailing costs which was supplied by the printer. The means of the log of the cost-per-response for Level 1 as 1.70, Level 2 as 1.64 and level 3 as 1.74. The ANOVA test statistic ($p > .05$) failed to reject the null hypothesis and revealed no significant difference in the cost-per-response rates when elevated levels of variable data were introduced. Figure 4.2 shows the means of the actual cost-per-response for each level.

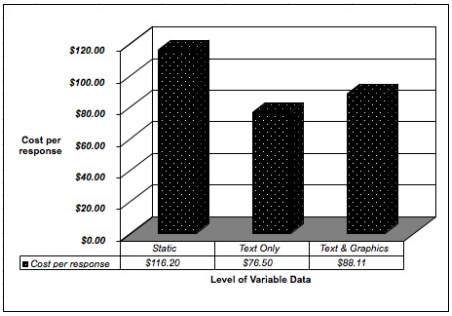

Figure 2. Means of the cost-per-response

Research Hypothesis 3: Variable data printing will provide a response rate benefit that exceeds the cost of production.

The objective of hypothesis 3 was to establish that the response rate benefit of higher levels of variable data was large enough to offset the increased costs of production for variable data printing. The cost rate benefit was calculated after each client-customer supplied the dollar value of a single response. This dollar value was divided into the total cost of the job to determine the number of responses necessary to break even with the cost of production. Any responses that fell above the break-even amount were considered a response rate benefit. Once the response rate benefit was established an ANOVA was used to determine if an increase in the level of variable data text or text and graphics generated a significant increase in cost rate benefit to offset the increased cost of production. The ANOVA ($p > .05$) failed to reject the null hypothesis and revealed no significant difference in the response rate benefit when higher levels of variable data were administered.

Figure 4.3 shows the means of the actual response rate benefit for each level.

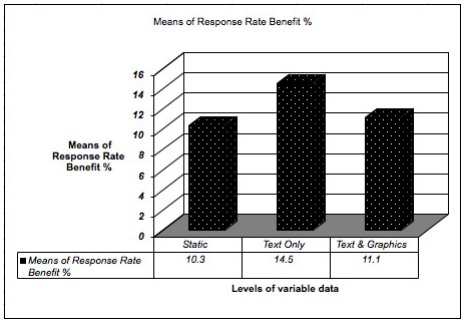

Figure 3. Means of the response rate benefit (percentage)

Results, Conclusions and Limitations of the Study

The subjects of this study were not recruited as the "perfect" companies to complete a VDP mailing, but rather they were selected from a group of companies looking to determine if VDP was appropriate for their needs. Two limitations came with this list of customers. First, was the inexperience of two companies in dealing with variable data and how best to maximize this opportunity. Case studies have shown that repeated use of VDP gives a better focus of how to maximize the piece to achieve the best results (PODi, 2003). One of the companies had some successful experience with versioning and was very interested in taking the process one step further to personalize the information on the mailing. The fourth participant of the study was a large national retailer that had considerable experience with mailings on every level.

The second, and one of the most notable conditions effecting the results of one customer's percentage of return was the knowledge and buying patterns of their customer. The static mailing piece had an unusually high 62% response rate (all response rates listed here are rounded off to the nearest percentage point). The VDP mailing did have a higher percentage, but the increased cost was not worth the return. This could possibly be explained because of the company's sophisticated, detailed up-front analytics. They really knew and tracked the buying habits of not only their customers, but all customers in their competitive marketplace.

When all four companies' return rates are calculated there is a statistical significance for the VDP printing. It did make a significant difference on the response rate. When the difference between using only variable text and using variable text with variable graphics was analyzed there was not a significant difference. This appears to have been greatly influenced by the national retailer's unusually high static response rate and the lower response rates from two of the other companies. The researcher observed several factors that may have had an effect on the outcome. First, two companies lacked experience in focusing the purpose for the mailing to drive specific response rates. These two companies had a difficult time calculating the value of a response, which truly has a critical impact on deciding the effectiveness of the mailing. A second factor that the researcher believes had an impact on the statistical significance was the designers' lack of understanding of how to use VDP. Designers were coached and offered suggestions on how to maximize the value of the VDP effort, but as new players they may have failed to maximize the message. Additionally, it was clear that the design firms had no strategy for pricing the cost of preparing a VDP piece. Reviewing the table shows in one case the price is doubled for the variable text piece when compared to the static piece, and the price is increased by the same amount for the variable text with variable graphics piece. It is obvious the designer did not take the time to truly calculate the costs. The customer paid the design fee and never challenged the costs. Since this was part of an academic research study, the researcher was professionally limited from interfering with this designer/customer component of the study. It is now obvious that in any further studies dealing with designers inexperienced with VDP, a pricing strategy needs to be covered with the customer before they enter into and agreement with the designer. The researcher felt this one example was the most lopsided, but believes all of the designers were somewhat off target with how they determined their costs.

There was no significance with the cost of the response and the use of variable data, but this would appear to be the effect of these design charges and the limited size of the mailing. The design charges have the same effect as conventional press makeready. As the run length goes up the cost of the design is spread out further and the burden drops for each piece to recover its share of the initial cost. Keeping the design cost realistic with the size of the mailing will always be a critical factor in determining the value of the cost per response.

The last component studied was the monetary value of the response. There was no significance here as well, but the researcher also observed that two the customers were not prepared to or accustomed to looking at the true value of a response. In the past they just did a mailing because it was time and clearly had not ever really been tracking the results.

Future Research Needed

The results of the individual mailings clearly show different response patterns. Further study needs to be performed after designers are educated to the strategies and mechanics needed in designing a variable data printing job. The customers also need background on how to position and structure their promotion to enhance the planned response. All selected customers should have prior knowledge of the value of responses and an understanding of the likelihood of a profitable campaign.

As the number of samples and subjects grow a better benchmark can be determined to identify when and where VDP is the most statistically significant successful opportunity. In an effort to collect better data Clemson University has developed a website that printers can calculate eight different ROI options for variable data jobs. By inserting actual costs and response rates printers can determine the return on investment for their customers for one, two or all three levels of variable data (static, variable text only and variable text with variable graphics). The website is located at http://graphics.clemson.edu/vdp and is in beta testing. All comments, concerns and recommendations can be addressed to ljohn@clemson.edu.

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Needs Assessment for Graphic Communications Education

Daniel G. Wilson, D.I.T. & Karen Murray, M.T.

Introduction

Graphic communications technology continues to develop and change at a rapid pace in the 2000s. Educators are challenged to keep pace, developing their own knowledge and skill base while incorporating new, relevant technology into program curriculums. A high quality graphic communications program will encompass curriculum that positions graduates to successfully pursue their chosen vocation within the field, and this requires exposure to relevant technological subject matter. For educators, balancing the need to include a wide array of technological subject matter with a finite amount of credit hour capacity creates a challenge regarding the selection of which content to include. What's more, the selected content may have ramifications far beyond the curriculum, reaching into areas of equipment and software requests, space allocation, staffing, and budgetary issues. With all of these challenges, educators require information from a variety of sources to make sound choices on curricular issues. This base of information will also help the educator better rationalize and articulate needs to administration, as well as validate the existence of the program. This research was done to add one piece to the information puzzle for graphic communications educators wishing to revise and develop curriculum.

Theoretical Background

Needs Assessment is the study done in order to design and develop appropriate instructional programs and materials. Much in the literature provides theory and guidelines on performing a needs assessment for instructional design (Dick, Carey, & Carey, 2000). Roger Kaufman, former director of the Office for Needs Assessment and Planning at Florida State University, is one of the foremost theoreticians on needs assessment applications in business and education (1983, 1986, 1994). Kaufman's model on the development of instruction starts by focusing on identifying a need, which can be pinpointed through the process of needs assessment. This might involve an in-depth study of subject matter, audience analysis, and the determination of prerequisite skills. But in the most basic sense, 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 that gap. The resulting information gained through needs assessment will help bring to light the extent to which current curriculum is successful and the extent to which it is not.

A needs assessment provides information on two levels. The first level is concerned with determining desired results, answering the question "where should we be as a program". The second level examines the current state of the curriculum through the collection of data. Both are important, interrelated ingredients to a full, robust needs assessment. The data collected to support the assessment may be qualitative in nature, for example focusing on the perceptions and attitudes of current students and recent graduates. The data may also be quantitative. Regardless, a complete needs assessment involves a collection of data from a variety of sources, with the ultimate goal of maximizing curricular relevance and quality. 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, industry leaders and potential employers. The data-gathering venues may be as diverse as personal interviews, phone interviews, or survey instruments. Once collected, this wealth of data can be used to provide sound rationale for curricular change and program development.

The Needs Assessment

Beginning in spring of 2003, a needs assessment was undertaken for the graphic communications program at the Pennsylvania College of Technology. The results 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 specific data presented in this publication are derived from a survey sent to representatives of Pennsylvania's printing industry. Other data that is not reported here was gathered from current students, graduates of the programs, industry leaders, and literature reviews. Therefore, data presented in this study comprise only a small portion of the total needs assessment picture. However, it is hoped that the data presented here may be useful for other graphic communications educators looking for additional information sources for there own needs assessment initiatives.

Research Questions

A survey instrument was developed as one mode of gathering information for the needs assessment. Discussions with industry and education representatives on the Pennsylvania College of Technology advisory board helped to develop a list of questions about the

current state of the industry. Answers to these questions will help direct curricular adjustment. It was decided to narrowly focus these questions to allow for a shorter survey, which it was hoped would increase the chance of a significant return rate. Through these efforts, six key questions emerged.

1. Which operating system is used most frequently for graphic production work?
   With Apple's recent change from OS 9 to OS X and with Microsoft Windows being a viable option for graphic production, questions concerning which platform to invest in for lab activities were raised.
2. How are files being transferred from customer to printer in today's industry?
   There are a wide variety of methods for transferring graphic files from customer to production facility. Feedback from advisory board members suggests that students should be exposed to file transfer technology other than exchanging disk media. Questions were raised about which transfer technologies are most prevalent.
3. By which methods are photographic images captured today and in what proportion?
   It is assumed that digital photography is growing rapidly, while capturing images by scanning prints and transparencies is on the decline. Decisions on image capture equipment purchases and curricular focus on scanning issues need to be informed by this kind of data.
4. How prevalent are color management workflows, including the use of ICC profiles and color profiling software, in production today?
   Much of the literature published on color image production today focuses on color management concepts, including the creation and use of ICC color profiles with graphic software, operating systems, and output devices. However, process color production can also be done "by-the-numbers", without reliance on ICC profiles. This question seeks an answer to the degree of adoption of color management in printing industry workflows.
5. Which page layout software programs are most used for graphic production?
   This question addresses the issue of software purchases and upgrades with regard to page layout software. While the curriculum focuses on principles of page layout and not on specific software packages per say, board members still feel it is important to provide lab experiences to students using software that will most likely be encountered in the workplace.
6. Which positions are most in demand in today's printing industry?

This question was asked to help validate the programs' production and management emphases and to help advise students on those career opportunities that focus on production and management-oriented functions.

The Survey Instrument

The 390 surveys were sent out to printing companies within the state of Pennsylvania. Forty-two usable surveys were returned (1 of the surveys was returned but not filled in) making an 11% response rate. The survey was designed as a four-page 8.5 x 11 self-mailer. No postage was required for the survey to be returned. A cover letter explaining the purpose and importance of the study was incorporated into the design. Check box answers were used for accuracy, minimal effort and a high response rate. There was no follow mail sent.

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 of U.S. printers.
2. All survey respondents were commercial lithographers; therefore, the results may not reflect the current technology and needs of advertising agencies, service bureaus, and printing businesses using other processes or focusing on other markets.

Data Analysis

1. Which computer operating system is used most prevalently in the printing production processes?
   The data show that printers use a mix of operating systems in production. Of those printers surveyed in spring 2003, only 31% were using Macintosh OS X for some portion of production work. Macintosh OS 9 was used for 74% of some portion of production work and Windows was used for some portion of production work in 62% of the companies surveyed. Macintosh OS 9 was the most dominant operating system used, with over 60% of printers using this platform for over 50% of production work. While the degree of Microsoft Windows use may surprise some graphic communications educators, the data suggest that Windows is used by only 31% of printers for over 50% of production work, and that no printers use the platform exclusively (see Table 1).

It is important to note that these data were compiled before QuarkXpress 6.0 (native to Macintosh OS X) was released. Based on the dominance of

QuarkXpress, suggested by the data shown in Table 5 and 6 below, it could be theorized that many printers using Macintosh computers were using Macintosh OS 9 at the time the data was collected because of QuarkXpress running natively only in OS 9. These same printers have since switched to Macintosh OS X. However, there is no data available to support this

	Percentage of Platform Use				
	0%	25%	50%	75%	100%
Mac OSX	69	14	0	12	2
Mac OS 9	26	12	2	29	29
Windows (98, 2000, XP)	38	29	7	10	14

Table 1. Percentage of platforms used in production work.

claim.

2. How are files being transferred from customer to printer in today's industry? The data suggest that removable disk is still that most common means of transferring graphic files from customer to printer. Data show that 62% of the printer's surveyed receive jobs on removable disk for 50% or more of their production work. Production jobs being transferred by e-mail is also significant, with 43% of printer's receiving files in this way for 50% or more of their production work and 93% of the printers receive at least some production files as e-mail attachments. Also significant is the use of file transfer protocol (FTP), with 43% of printer's having FTP capabilities. These data suggest that printer's are receiving files in a variety

	Percentage of Total Files Received				
	0%	25%	50%	75%	100%
Removable disk	5	31	31	31	2
FTP	57	29	14	0	0
Bulletin Board/ Automated Transfer	90	10	0	0	0
Email	7	50	33	10	0

Table 2. Percentage of files received in a particular format.

of ways (see Table 2).

3. By which methods are photographic images captured today and in what proportion? The data suggest that scanning images is decreasing and digital photography is increasing. In fact, 78% of the printer's surveyed receive digital images for 50% or more of their production work, rather that prints or transparencies for scanning. Also, 98% of printer's surveyed received images in digital format for at least some portion of work. Even with the dominance of digital format images, all of the responding printers receive both prints and transparencies for scanning for at least some portion of their work, with prints being received

	Percentage of Total Images				
	0%	25%	50%	75%	100%
Transparencies	55	45	0	0	0
Prints	31	43	14	12	0
Digital format	2	19	19	45	14

Table 3. Percentage of images received in a particular format.

more often than transparencies (see table 3).

4. How prevalent are color management workflows, including the use of ICC profiles and color profiling software, in production today? Respondents were asked to indicate whether they used color management, including ICC profiles and profiling equipment in their color workflows. The data show that 79% of responding printer's print process color images. Of those printer's, most use a color management workflow. However, nearly one third (31%) of all printers surveyed do not use color management software, but rather prepare and print process color without ICC profiles. The data do not indicate what kind of controls these printers are using to prepare images. The data does suggest that color management technology has made its way into production

%Yes	%No	%No response
48	31	21

Table 4. Color printing using ICC profiles

workflows with great frequency (see Table 4).

5. Which page layout software programs are most used for graphic production? QuarkXpress is the most prevalently used page layout software program, with 59% of printers surveyed receiving Quark files for 50% or more of their production work. While the

	Percentage of All Layouts				
	0%	25%	50%	75%	100%
QuarkXPress	5	36	21	38	0
PageMaker	29	64	5	2	0
InDesign	79	19	0	2	0
PDF	33	50	10	7	0
Other	52	33	7	7	0

Table 5. Percentage of page layouts are received from customers in the following application formats.

survey did show that Adobe PageMaker and Adobe InDesign files are also received, 29% of printers never see PageMaker files and 79% never receive InDesign files. Interestingly, 67% of the printers surveyed receive PDFs from customers for at least 25% of the total amount of layouts received. (see Table 5).

Of the printers involved in page layout on-site, 72% use QuarkXpress as their primary layout tool. Surprisingly, only 2% of the respondents use Adobe InDesign. This data was received in late sprint (May 2003), before the release of QuarkXpress 6.0 for Macintosh OS X. It had been theorized that many printers and customers may have switched to Adobe InDesign, because it had been aggressively marketed by Adobe and ran natively on Macintosh OS X since its inception. But the data suggest that graphic communications professionals continue to use QuarkXpress running either in Macintosh OS 9 or OS X classic more than competing programs (see Table 6).

	Percentage of All Layouts
QuarkXPress	72
PageMaker	10
InDesign	2
Other	16

Table 6.

6. Which positions are most in demand in today's printing industry? The printers were asked to project which production positions they would need over the next three years. The data suggest that production positions in the pressroom and finishing area are most in demand, with 71% of printers projecting a potential need in press operation and 71% in finishing operations. The need for preflight personnel was also significant, with 52% of printers projecting a potential need. Lowest were needs in scanning and image editing (only 24% of printers projecting a need). This correlates well with the data on how printers are receiving images—more in digital format, rather than prints and transparencies (see Table 5). Output technicians, those individuals that trap, impose and proof jobs are also in demand, with 52% of printers projecting a need (see table 7).

	Response		
Job Title	No	Perhaps	Yes
Preflight Technician	48%	26%	26%
File Repair Technician	69%	19%	12%
Scanner Operator/Image Editor	76%	14%	10%
Page Layout Technician	45%	36%	19%
Output Technician(trap/impose)	48%	26%	26%
Press Operator	29%	31%	40%
Finishing Specialist	29%	31%	40%

Table 7.

Printer's projecting professional or management-oriented positions indicated a glaring need for salespeople, with 81% of respondents indicating a need. Next most in demand were customer service representatives, projected to be potentially be needed by 76% of printers over the next two years. Of these printers, 38% indicated a definite need over the next two years. The lowest need was for production supervision, with only 7% indicating a definite need. It should be noted that the survey was worded to make it clear that there were entry-level positions—many printers would not hire a production supervisor on an entry-level track (see table 8).

	Response		
Position	No	Perhaps	Yes
CSR	24%	38%	38%
Salesperson	19%	38%	43%
Estimator	48%	33%	19%
Production Management Assistant	62%	31%	7%
Production Supervisor	72%	21%	7%
Quality Control	64%	29%	7%

Table 8.

Discussion

The data suggest that the Macintosh platform is used more prevalently than Microsoft Windows for graphic production work. This data may be helpful to educators making decisions on computer laboratory equipment and requiring a rationale for their decisions. Microsoft Windows is used as the primary platform by one quarter of the printers surveyed. This suggests that curriculums need to focus on both operating systems, as graduates likely will need to function in a multi-platform environment.

While these data show that Macintosh operating system 9 is used for production work more than Macintosh operating system X, it is important to note that QuarkXPress 6.0, native to OSX was not released until after this survey was completed. Because the data show that QuarkXpress is the dominant page layout software program, both within the production facility and as a native file format received from customers, it could be assumed that users of Macintosh OS 9 will have upgraded to OS X after QuarkXpress 6.0 was released.

The data also suggest that a large percentage of layout production is being sent to printers in the Portable

Document Format (PDF). Sixty-seven percent of printers indicated that PDFs are being received for at least 25% of their work. These numbers correspond well with the 2002 GATF Press report, The PDF Era: Usage in the Real World. In that study, 23% of files received by printers were in the PDF format. This reflects a need for educators to focus curriculum on PDF production for print media, as well as providing students with an understanding of document composition. It appears from the data that Adobe InDesign has yet to make a major impact on layout production. However, 21% of printers indicated that they did receive at least some native InDesign documents for print production jobs, though only 2% indicated that they use InDesign as their primary in-house page layout program for production work. It might be argued that because Adobe InDesign has such robust PDF export functions, that some of the PDF documents being received by printers originate as Adobe InDesign files. However, this is impossible to tell from the data.

The data does suggest that removable disks are still a major method for file transfer. However, printers are receiving even more files as e-mail attachments, and a large share by file transfer protocol. This data suggests that curriculums need to focus on issues arising from these file transfer technologies. For example, students may need to learn about ftp server technology and about potential problems arising from files received as e-mail attachments. Bandwidth issues, cost comparisons, and system reliability are also important topics intimated by the data.

It appears from the data that the use of scanning technology is on the decline in the industry. With 98% of the printers responding indicating that digitally captured images are received for some work and 60% of printers receiving 75% of the total images in digital format. This suggests a clear need for curricular content in digital photography and, perhaps, a de-emphasis on scanning. Scanning is still technologically necessary for the reproduction of very large images, due to resolution limitations of even the highest-end digital cameras, but educators may need to balance investment dollars between scanning technology and digital cameras.

Image editing remains a curricular topic regardless of how an image is captured. In this regard, color management, including the use of ICC profiles and color profiling software, has made its way into production facilities, with nearly 50% of printers implementing a color management system. At the same time, many printers who reproduce color do not use a color management system. The data do not indicate how these printers are controlling and predicating color quality.

The data does suggest that printers within the state of Pennsylvania have a strong demand for workers both in production and management areas. The highest needs within the production area were for press operators and finishing equipment operators. Lower demand was for prepress production workers, with about one quarter of printers indicating a definite need for preflight technicians and output technicians. The highest demand among professional positions was for salespeople, with 43% of respondents indicating a definite need. Demand for customer service representatives was also high, with 38% indicating a definite need. This information may not extrapolate to other states or markets outside of commercial printing. However, the data does provide some solid evidence to provide guidance to students seeking a career path.

Summary

Continual technological change is the norm in the graphic communications industry and educators must stay abreast of trends and be prepared to adjust curricular content to reflect the current state of the field. The needs assessment is a means of providing information necessary to assure that curricular content best meets the needs of students within the context of the educational institution and the industry for which they are prepared to work. This study focused on a set of questions to help provide quantitative data to the needs assessment efforts of one college program. It is hoped that the information will provide at least a partial picture of the current state of the diverse graphic communications industry.

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An Investigation of the Non-Financial Performance of Printing Firms for Performing B2C Operations on the Web

Devang P. Mehta, D.I.T.

Introduction

The Web is one of the fastest growing business tools. Companies can use Web technology to publish the information about their products and services, to market and sell their products and services, to communicate with their customers and suppliers, to offer technical support, and to receive payments. Findings gathered from the review of literature showed that most of the business people from different industries believed that using the Web technology as a business tool can positively affect the non-financial performance of their companies. This paper investigates the perceived non-financial performance of commercial printing firms for performing business-to-customer (B2C) operations on the Web. The criteria used for measuring the non-financial performance were number of customers, merchandise return rate, and sales and marketing productivity. These non-financial performance criteria may play an important role on affecting the financial performance, since they are related with financial performance criteria, such as, profits, sales, costs, and return on investment.

Purpose

The purpose for conducting this research was to determine how commercial printing firms are performing non-financially while conducting B2C operations using Web technology. Three non-financial criteria were used to measure the non-financial performance.

Problem

The problem of this study was to determine the non-financial performance of commercial printing firms regarding their B2C operations on the Web with respect to their previous performance without the online operations. It was found from the review of literature that business people of different industries believed that conducting B2C activities on the Web affects performance of their companies. Nothing specific was found regarding commercial printing firms.

Hypothesis

Based on the review of literature the hypothesis was formulated. The hypothesis stated that performing B2C operations on the Web affects the non-financial performance of a commercial printing firm.

Review of Literature

This research study was partially based on the diffusion of innovations theory. Rogers (1995) defined diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" (p. 5). The innovation can be an idea, practice, or object that is perceived as new by an individual or other unit of adoption (Rogers, 1995). In this study, the Web is such an innovation or technology and its diffusion in the society in terms of how it brings changes to non-financial performance of commercial printing companies was discussed. Consequences are the changes that occur to an individual or to a social system as a result of the adoption or rejection of an innovation (Rogers, 1995). In this study, changes related to non-financial performance were investigated as a result of adoption of Web technology for performing B2C operations.

There are many illustrations of desirable, direct, and anticipated consequences with Web technology. McLean (2000) said that Web sites could be powerful tools for printers, if they were well constructed. He added that Tonya Starr, president of Premierprinter.com, cited the research study finding that a company that has a Web site achieves a 35 percent higher level of credibility than to a company that doesn't. Behrens (1997) indicated that the usefulness of e-mail and Web sites as present-day marketing vectors can trigger sales promotion, and thus can be widely used by many printing companies. Hirshowitz (1997) stated that the World Wide Web provides several benefits to quick printers. Kinko's uses its site to display products and services; while Herndon, Virginia-based Insty-Print generates $5,000 to $15,000 monthly sales on the Internet (Hirshowitz, 1997). Hirshowitz (1997) cited that AlphaGraphics in Scottsdale, Arizona, developed a Web site that allows customers to transact business with its 300 franchised print shops worldwide. Frank Romano, chair of the School of Printing, Rochester Institute of Technology, mentioned that e-commerce would allow printers to deal more efficiently with the everyday rapid changes ("E-commerce options," 2000).

There are undesirable, indirect, and unanticipated consequences associated with Web technology, also. Roth (1998) finds that not many graphic communication companies are making profits by conducting business-to-customer activities on the World Wide Web. She says that

only 11% of respondents believed that they made money. It was stated in the "the ultimate e-commerce study" (2002) that the Indian industry has clearly understood that e-commerce is not a solution for all business problems and marketing strategies. A blind choice of technology has further added to many firms' problems, those who have been unable to comprehend the effect of the Web on their businesses. Durfee and Chen (2002) indicated that one of the important lessons learned in the last year is that e-commerce is not for everyone, because investments are significant, and mistakes are expensive and highly visible. Burke (1997) discovered that existing retailers have also been reluctant to support electronic shopping for the following reasons:

1. Building and maintaining a Web site requires a significant investment of timeand money with an uncertain return on investment.
2. If retailers post their prices on the Internet, customers and competitors haveeasy access to this information, increasing market efficiency and reducing margins.
3. Electronic-sales incur shipping and handling costs.
4. Electronic-sales have higher return rates of goods because sometimes customers do not obtain the goods that meet their expectations.

Auger (1997) conducted similar research to investigate the relationship between a Web strategy and the financial and non-financial measures of performance of a company. He concluded that there were positive associations between multi-objective sites and overall performance, between advertising of the Web site and overall performance, between the number of visitors and overall performance, and between the frequency of site updates and overall performance. He found a negative association between complicated and enormous Web site design features and services with overall performance. Further, Auger found that the more complicated the Web site, the less the number of visitors. Hence, the overall performance could be negatively affected.

Nath, Akmanligil, Hjelm, Sakaguchi, and Schultz (1998) conducted researchon e-commerce. They interviewed executives of ten organizations. They found that the executives believed that the Internet was an inexpensive advertising tool which can reach a huge audience, the barriers to conducting business were minimal, and an Internet presence improved the image of the business. However, they also found that executives were worried about security, costs, site maintenance and support, lack of knowledge, lack of skilled personnel, and legal issues.

Connolly, Olsen, and Moore (1998) conducted research on e-commerce for the hotel industry. They concluded that the Internet was capable of boosting revenues of hotels by extending the company's reach to global markets, reducing costs by over-riding traditional distribution channels, and improving customer services with better information in a multimedia form. They said that although the Internet offered important benefits, the hoteliers were concerned about issues like customer's privacy and data security.

Based on the literature, Web technology brings about both positive and negative consequences that affect organizational performance. Positive consequences of Web technology, such as reaching a large number of customers, online marketing and sales, online transactions, and customization of messages, usually improve performance of a company. On the other hand, there are negative consequences as well, such as the costs of building and maintaining a Web site, shipping and handling costs for tangible goods, higher return rate of items sold on the Web, and increasing competitiveness.

Methodology

A survey instrument, questionnaire, was pre-tested for its validity and reliability. A pilot test was conducted to check the validity of the questionnaire, eliminate any ambiguity, and make appropriate changes according to respondents' suggestions. A targeted sampling technique was applied to select the final subjects. Commercial printing firms of the midwest region of the United States who had Web sites were selected. Questionnaires were sent to appropriate graphic communications professionals such as presidents or owners, vice-presidents, directors, and marketing managers of those firms. A seven-point Likert scale was used to measure the non-financial performance. The seven-point Likert scale was designed as: (1) strongly disagree, (2) disagree, (3) somewhat disagree (4) no difference, (5) somewhat agree, (6) agree, and (7) strongly agree. Three non-financial indicators, including number of customers, merchandise return rate, and sales and marketing productivity were used to measure the non-financial performance. The mean was calculated for each non-financial indicator. The t-test was performed to measure the effect of Web technology for performing B2C operations on each non-financial indicator (Table 1).

Findings

A total of 38 questionnaires out of 103 subjects were received. The response rate was 36.89%. Approximately 31% of the total respondents believed that conducting business-to-customer activities on the Web does not affect non-financial indicators of performance, such as, number of customers and sales and marketing productivity. On the other hand, 84.21% of the total respondents perceived that performing B2C operations on the Web does not

affect merchandise return rate. One of the significant results found from this study was conducting business-to-customer activities on the Web positively affects non-financial performance (x = 4.32, p = 0.0176) of a commercial printing firm that is significant at _ = 0.05. This supports the research hypothesis. The result was obtained because non-financial indicators, number of customers (x = 4.63, p = 0.0028) and sales and marketing productivity (x = 4.58, p = 0.0019) were positively affected at _ = 0.01. As a result, the negative effect of another non-financial indicator, merchandise return rate (x = 3.74, p = 0.0289) to the non-financial performance is unseen.

The mean of the merchandise return rate is affected by the few extreme outliers. Those outliers can not be discarded because the responses could be true for those particular companies. However, the results of these outliers may not be representators of most companies, the merchandise return rate that is negatively affected at _ = 0.05 can not be generalized because of a few extreme outliers. As discussed earlier, 84.21% of the total respondents said that performing B2C operations on the Web did not affect merchandise return rates.

Non-Financial Performance Indicators	Means	G/L	t-Test Procedure	
			t-Statistics	p-value
Non-Financial Performance	4.32	G	2.19	0.0176*
Number of Customers	4.63	G	2.94	0.0028**
Merchandise Return Rate	3.74	_L	1.96	0.0289*
Sales & Marketing Productivity	4.13	G	3.09	0.0019**

Note: G = H_0: _ _ 4 against H_A: _ > 4
L = H_0: _ _ 4 against H_A: _ < 4
*significance level _ = 0.05
**significance level _ = 0.01

Table 1. Degree of Agreement/Disagreement of Non-Financial Performance Indicators

Conclusions

In relation to the consequences of an innovation model, it is concluded that the use of Web technology as a business tool brings desirable, direct, or anticipated changes to most of the commercial printing firms; that is, it increases number of customers and sales and marketing productivity. It brings undesirable, indirect, or unanticipated changes to few companies; that is, there is increase in a merchandise return rate. Performing B2C operations using Web technology has a positive significant effect on the non-financial performance of commercial printing firms.

Recommendations for Future Research Studies

Recommendations are made based on research methodology and findings. The following recommendations are made for future research studies.

1. A longitudinal experimental study should be conducted in a commercial printing firm in order to study the effect of Web technology on the non-financial performance, once it is introduced.
2. A research study should be performed with a larger sample size of commercial printing firms to verify the results, and generalize findings for the larger population.
3. A correlation study should be performed to determine the relationship between independent variables and the dependent variable, non-financial performance. The independent variables include Web site features, advertising of the Web site, the length of Web site operation, the number of visitors, and the Web site modification frequency.
4. The above-mentioned research studies should be conducted in different industries to investigate the impact of Web technology on their non-financial performances.

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What Preparation do Graphic Design Students Need to be Successful When Designing Products for Commercial Printing?

Eugene Van Roy, M.Ed.

Introduction

Foreseeing the inevitable changes in technology, students studying Graphic Design face ever-changing career choices. Laidlaw, a creative director for Weymouth Design, Boston, summed it up by saying, "Young designers can come up with an incredible design but often aren't fluent in their ability to get the piece produced. They need to learn the lingo - to speak the same language as printers." (as cited in Rosenberger, 2000). This would imply that graphics faculty need to ensure that students of graphic design at their schools graduate with the necessary skills to become successful in the career field that they have chosen.

This project is very important in that the people in the graphic design and commercial printing worlds have come to look upon themselves as being in two separate universes. The two worlds have crashed into one another and they are still trying to determine for what each is responsible. There is no available data on this from any formal survey of the commercial printing industry or graphic designers. The only data available that indicates an existing problem is in articles written in various trade publications. The intended outcome of this project is to bring the "warring" factions together to create a peaceful coexistence between two career fields that need to work in unison to continue producing the high quality products for which the industry is known.

Historical Overview

Looking back in history we found that at one time graphic designers and printers had coexisted in harmony. When Johann Gutenberg printed his Bible, he worked very closely with graphic designers; on each page that had a dropcap there was a distinct graphic design put around the dropcap. This had to be drawn in by hand.

More recently, the topic of "what a graphic designer needed to know about the commercial printing industry" is discussed in the back rooms of print shops, at advisory committee meetings, and at the banquet tables of prepress conferences. It is a topic in which everyone had pointed at someone else as responsible for what the graphic designer needed to know about the printing industry.

Ten years ago, when a student entered a typical technical college graphic design program their primary courses of study dealt with typography, illustration, layout artistry, and air brush artistry. Primarily, if students could draw usable pieces of art, they became very successful in the graphic communications industry. In the late 1970's, one "midwestern technical college" also required design students to take an innovative course that instructors believed would enhance their understanding of the printing industry. This course was titled Commercial Printing Basics. It provided the graphic design student, also known at that time as commercial art students, a general overview of the commercial printing industry.

At that time, the graphic designer only created illustrations and comprehensives to be approved by the client. A comprehensive layout was a detailed drawing produced as closely as possible using colored pencils, felt tipped pens, or tempera paints to give the customer a simulated visual preview of what the printed piece would look like. The layout then proceeded to a very unique group of people in the commercial printing industry who worked with the illustrations and comprehensives. Through various steps, such as paste-ups, typesetting, process camera photography, scanning, film assembly (stripping), and platemaking, the printing plates were created and then sent to the press operator to produce the printed piece.

By the mid-1990's computer and scanner technology had become so advanced that the paste-up artist, typesetter, process camera operator, and scanner occupations had all become virtually extinct. Additionally, the development of technologies to go directly from a computer to a printing plate, along with the digital technology to go directly to the press, introduced graphic design students to significant occupational changes.

The authoritative information in use in this paper is based on the fact that occupational transitional change has and continues to happen. There is no clear task analysis of which occupational area is now responsible for the tasks of composing and preparing page layouts, color management, page imposition, and a series of other prepress tasks which once were done by occupational areas that no longer exist in the commercial printing industry. Upon review of the Occupational Handbook, the occupational descriptions and tasks that are described as a career guide for graphic designers is ten years behind the current technology.

In some preliminary reports of advisory groups, college personnel are beginning to hear more concerns that the graphic design student is not properly prepared to adequately produce materials for the commercial printing

industry. These preliminary reports have alerted technical college staff to the fact that they have a responsibility to provide both an adequate work force for the future needs of the graphic communications industry and prepare the students with the training and understanding of new technologies. Graphic Communications faculties need to address what course changes and content need to be added and deleted to help make the students successful in the 21st century. The primary vision of this project is to have a positive effect on Graphic Design students in preparing them to become successful professionals and to develop lifelong career and self-motivational learning habits.

The Printing Industry

Printing is a great business and the print media sector is huge; it is one of the largest and most important sectors of the U.S. economy. Although there are a few printing companies with a billion dollars in sales, the majority of printing done in the United States is typical of the small, mom-and-pop businesses. Thousands of men and women across the country have realized the American dream of owning their own business. The printing industry is one of the best examples of the entrepreneurial spirit, which has made the United States the economic envy of the rest of the world. While running a successful print media company is more challenging today than it was in the past, the graphic communications sector of our economy still offers tremendous opportunity to Americans who have a desire to set up their own business - to be their own boss.

The following statistical information comes from the Graphic Arts Technical Foundation 2002 Technological Forecast. Although the average printing company is a small business, approximately 25 employees or less with three million dollars or less in annual sales, the combined impact of the approximately 47,000 firms which make up the industry in the United States is huge. Over one million people are employed in the 47,000 printing firms and over 163 billion dollars worth of printed products were produced in 2001. Printing is the nation's third largest business in the manufacturing sector (Davis, 2002).

Research Focus Group

For the purposes of this project, a focus group was established that included members representing the graphic design and the printing industry perspective. Mrs. Barb Fischer, Graphic Design Instructor, was the primary graphic design support in this project. Mrs. Fischer contributed to this project by making sure that the focus was on what tasks the designer needed to produce materials for the print media. There was a specific desire to not lose the perspective that we were training these individuals to be graphic designers and not solely prepress technicians (B. Fischer, personal communication, September 5, 2002).

The secondary graphic designer was Tracey Ryan, Graphic Designer and Trainer at the Graphic Arts Technical Foundation in Sewickley, Pennsylvania. During an interview, Miss Ryan reinforced her belief that some of the basic elements of page layout such as font management, trapping, color management, and image resolution were just a few of the tasks that graphic designers needed to master. These are necessary in order to produce projects that would not cause production delays for commercial printers (T. Ryan, personal communication, August 4, 2002).

There was not a substantial amount of industry data available, so some industry representatives from the local area were recruited–Mr. Michael Sass and Mrs. Margaret Gernes. The primary industry source for this research, Mr. Sass (Prepress Manager for Johnson Printing in Rochester, Minnesota) graciously volunteered to be the prepress consultant on this project. He was personally interested in this project because the topic affected him and his staff in meeting their daily production deadlines. (M. Sass, personal communication, September 20, 2002). Mr. Sass also assisted with the development of a survey form outlining six main task areas: Orientation to Electronic Publishing and Software Applications (18 tasks), Job Engineering (15 tasks), Image Capture (9 tasks), Digital Output (8 tasks), Basics of Press and Binding and Finishing (16 tasks), and Conventional Image Assembly (8 tasks). The survey asked if designers should have a working knowledge or have a basic skill level in each of the task areas before entering the work force.

Mrs. Gernes, a production scheduler at a midsize printer, Crescent Printing in Onalaska, Wisconsin was in charge of the scheduling and monitoring of all jobs that Crescent Printing had in production. She contributed data on problems that their customer service representatives encountered with graphic designers with whom they worked. Mrs. Gernes provided a list of common problems that they had with jobs designed outside the plant. These included such problems as paper specifications, layout and imposition, font, and color issues. (M. Gernes, personal communication, October 31, 2002). These same problems were identified by other focus group members when they were presented the question regarding graphic designers and what they should know about the commercial printing industry.

Research Background and Design

This project was based largely on personal interviews with people from the graphics industry on both sides of the fence. The people interviewed are listed as follows: Ms. Tracey Ryan, a graphic designer and trainer for the

Graphic Arts Technical Foundation; Mr. Michael Sass, a prepress manager for a midsize commercial printing company, Johnson Printing in Rochester, Minnesota; Mrs. Margaret Gernes, production scheduler at a midsize printer, Crescent Printing in Onalaska, Wisconsin; and Mr. Frank J. Romano, Professor in the School of Print Media, Rochester Institute of Technology, Rochester, New York, and coauthor of the book: Designer's Prepress Companion. After these interviews, the conclusion was that each type of facility had different prepress demands of their designing clients and that the technical college faculty could not base their department curriculum only on limited research and study with only a few people in key positions in the industry. These interviews only reinforced that more surveys of design and ad agencies, prepress houses, and commercial printers must be conducted.

Mr. Romano is the founder of Electronic Publishing, a trade journal for the graphic arts industry. Mr. Romano explained that some research was conducted as a project by a group of students who were working on their graduate degree at Rochester Institute of Technology. They conducted surveys of graphic designers at various conferences to see what they knew about the commercial printing industry. From this research project evolved the Designer's Prepress Companion (F. Romano, personal communication, December 11, 2002). The Designer's Prepress Companion basically stated that designers have been faced with more technical requirements and had to be more accountable for what they were designing.

> From the very first sketch, today's designer must keep in mind the technical requirements the design will encounter along the way. Modern graphic artists use sophisticated software that permits designs to be executed in days, that before would have taken weeks. But with this creative freedom comes the need to understand and be accountable for how the design will work within the technical requirements of the printing process.
>
> Prepress design is now truly a comprehensive stage of the printing process that demands technical know-how, microscopic attention to detail, and the constant awareness of tempering the design to a printer's capabilities. The more a designer can learn how to accommodate the printing process, whether traditional or digital, the more the designer will ensure producing a design that is not only compelling, pleasing, and commercially viable, but is printable - and profitable for all concerned.
>
> Begin with the end in mind - and understand the steps in between - and your design will be successful. This book is written to help you along the way. (Berlin et al., 2002)

N. A. Hitchcock (September 2002 issue), senior associate editor of Electronic Publishing magazine wrote an article entitled, "Clients tap designers print skills." The author explained the beliefs and experiences of a Miss Sharon Elwell, owner and founder of Elwell Designs in Massachusetts. This author gave reinforcement to the long argument; Do designers really need to understand the print media? Miss Elwell, along with Kevin Lentini, account executive of Synergy Graphics in Wilmington, Massachusetts, explained how working with a designer with a print background saved time and money during the printing stage and for the clients with whom she dealt. This supported my argument that graphic design students would be more apt to be successful with a good solid print background. Hitchcock (2002) stated in her article;

> Some people think designing and printing are two separate worlds, but for Sharon Elwell of Elwell Design, merging the two techniques is a winning combination for her and her customers.
>
> Elwell, who has run her own design studio for nine years, produces marketing collateral, posters, ads, and billboards for clients including corporations and universities. Key to delivering well-designed printed pieces with confidence, she reports, is having a strong knowledge of print, and print management skills.
>
> As a result of her design and production expertise, Elwell has saved her clients thousands of dollars, resolved challenging print issues, met tight deadlines, and produced award winning jobs. But best of all, her experience keeps clients coming back. The majority of them have been with her for years, some for more than a decade; most of her business is attained by word of mouth.

The initial collection of data produced sources that were mostly short articles covering very narrow areas that writers believed needed to be addressed in order to help the graphic designer understand the new technological changes. Every article started out with almost exactly the same opening phrase, "Graphic designers have faced increasing print production responsibilities." (Wilken, 1995) The same or very similar quotes could be found in each additional article, but no one had really defined the responsibilities of the graphic designer and the prepress person. The more the focus group studied these sources, they realized that knowing how something would print while it was being designed caused a lot less heartache throughout the printing and finishing stages of production. Good production knowledge, and contact with the printer in the planning stage, meant the designer and printer could collaborate and came up with the best way to execute the job.

If a designer got into a fairly complicated project, the most important thing was to consult with the printer to try and obtain input to make the whole project go smoother. This way the end user would get a better product. Designers should involve the printer early, especially if their pieces had finishing and bindery needs, color,

aqueous coatings, and varnishes.

A unique comment made about an article was that, even though the author (Wilken, 1995) was talking about the years from 1990-1995, this very article could still be used today. Graphic designers were not pleased that personal computers had increased graphic productivity while decreasing graphic creativity. In the production workflow for print media which continued to see increased technology, the tasks that a graphic designer had now become responsible for have decreased the time to be creative. Wilken (1995) supported this early 1990's trend as follows:

> Graphic designers have faced increasing print production responsibilities from 1990 - 1995. Advanced digital techniques and difficult economic times have resulted in new job responsibilities for graphic designers. Graphic designers are not pleased that personal computers have not only increased graphics productivity but decreased graphics creativity. They also believe quality has been decreased.
>
> During the past five years the graphic design community has come under increasing pressure to be responsible for more elements in the print production process. This has been brought about by advancing digital technologies (hardware/software) as well as tighter economic conditions. (Wilken, 1995).

Moore (1998) tried to define who was responsible for designs that were being created in the digital workflow. The research from this article reinforced the fact that there were problems with computer files coming from designers that were costing graphic communications companies both time and revenue. Even though this article was written in 1998, it had once again reinforced that a problem still existed. Individual members of the focus group agreed that each one of the problem areas stated in this article still existed and caused production delays, additional work-hours, and expense to each one of their companies.

> The responsibility of graphic arts designers have grown from just being artists who are involved with creating art and layout files to professionals who are accountable for the integration of the graphic design with digital production. This increased responsibility requires graphic designers to closely work with the client, the prepress house, and the printing company. Thus, graphic artists have to develop more technical knowledge and improve their communication skills.
>
> Whether they are in-house at an ad agency or work as free agents, today's graphic designers not only are involved in the creative side of a project, but also are expected to set traps correctly, establish low-res/high-res image OPI swap-out later in the production cycle, include all fonts with the job, and never-ever-create a file that doesn't print.
>
> Sarah Rosenbaum cites a recent study by the Graphic Arts Technical Foundation on prepress costs and lost revenues.A whopping 57% had something wrong with them, i.e. bad raw materials," Rosenbaum reiterates. "Missing file components included fonts, graphics, instructions, and incompatible file formats. Cited in the report as the #1 revenue loss/expense was rework, and the #1 problem there, at 22% was missing fonts." (Moore, 1998).

Bonoff (2002) stated that today's prepress career field was now beginning to see that in order to survive, it must have a creative side. The reason for the use of this area of research was that until the digital age, prepress people were technical in nature and design people were creative while both had their unique occupational areas. "While the traditional prepress industry has a creative side, offering creative and design services is a substantially different business than prepress. It requires a different business model, a different sales approach, and a new production workflow." (Bonoff, 2002) As the two areas were merged an entirely new occupational area opened and it gave the graphic design student another occupational area in which to find employment.

Research Procedure

The first survey form was to be sent only to Commercial Printers. After consulting with the focus group, the recommendation was made that the survey form should be sent to both Commercial Printing Prepress Managers and to Advertising Agency Art Directors within a 100 mile radius of the technical college district to determine what needs the industry was facing. In this area, there are approximately 247 Commercial Printing facilities and approximately 85 Advertising Agencies. This geographic area was selected because graduates of the "midwestern technical college" obtained employment throughout Wisconsin, Eastern Minnesota, and Northeastern Iowa. Included in the survey was a request for information from graduates who worked directly with the commercial printing industry to see what changes would be needed in the curriculum.

Of the 247 surveys sent to Commercial Printing Prepress Managers, 60 were returned for a return rate of 24%. Of the 85 surveys sent to Advertising Agencies Art Directors, 22 were returned for a return rate of 25%. The recipients were asked to choose one of three categories of answers in the survey.

The necessary level of expertise was determined by breaking it down into two categories. The first category was defined as the knowledge level. Does the student have the knowledge and understanding of a particular task? The second category was defined as the skill level. Does the student possess the skills needed to perform this task? Some of the task areas might only require the knowledge

level and some areas would require both the knowledge and skill levels. In the third category the survey recipients were asked to determine if the task did or did not apply and if it should be deleted from the curriculum.

Research Results

The data retrieved from surveying Advertising Agencies Art Directors showed that in approximately 70% of the tasks listed, 50% of the people surveyed stated that the students needed a knowledge of the tasks and the other 50% stated that the students needed a working skill level of the task.

When reviewing the Commercial Printing Prepress Managers survey results it was found that the data was very similar to that of the Advertising Agencies Art Directors.

When combining the data from both Commercial Printing Prepress Managers and Advertising Agencies Art Directors, an almost even split was found as to whether or not the student should have a knowledge level or whether the student should have a working skill level. The only area that showed any difference was Task 6: Conventional Image Assembly. The returns showed that one third of the people surveyed stated that students still needed knowledge; one third of the people stated that students still needed a skill level; and one third of the people stated that students didn't need either.

Even though the information did not come back with a clear and decisive difference between knowledge needed and skills needed, the surveys did show that both Commercial Printing Prepress Managers and Advertising Agencies Art Directors agreed that the graphic design students still need some type of training in the area of commercial printing. Because the data did not give us a precise level that the students needed to obtain, a focus group of both graphic designers and commercial prepress personnel will review this data and establish a task analysis to define the skill level required of graphic design students.

An unexpected fact was that the survey results reinforced the umbrella curriculum proposal that was presented in 1998 by an Associate Dean of Industrial Technologies at "midwestern technical college" (R. Westpfahl, personal communication, February 5, 2003). It was stated that the graphics department should be combined under one program using the name of Graphic Communications, with basic core classes that both Graphic Design and Printing and Publishing students would be required to take. After completing the core curriculum, students could then major in various concentrations such as: Graphic Design, Prepress Technician, and Press and Post-press Operators.

Recommendations for Change

As this project came to a close, it was not the intent of this project to change or in any way to detract from the ability of the designer to continue to retain his/her creative side. Watterson stated, "Designers in recent years have had to learn a great deal more about production and the intricacies of the process. This steep learning curve has often placed the designer at odds with the printer." (Watterson, 2003)

Now that the survey is completed and the results have been tabulated the recommendations will be presented to the "midwestern technical college's" Graphic Design staff. This info will be used to determine what changes should be made in the curriculum to produce a more successful graphic design student. Hopefully, this will better prepare the student to not only understand the changes that are happening, but also teach them to continue researching and exploring new and better technology and theories.

If recommendations are adopted by the Graphic Design Advisory Board, the new program curriculum will be implemented for the spring semester of the year 2004. The first comprehensive assessment will be conducted in the spring of 2005. This will be approximately one year after graphic design students have graduated from the program and have had time to work in the industry. This amount of time will help them determine whether or not the changes that have been made met the needs of both the student and industry.

Saul Bass (as cited in Watterson, 2002) once said, "The invention of the typewriter did not make for better poetry." This should help us understand that even though we have these vast and marvelous computer applications that allow us to do wonderful things, it is necessary to know considerable information. Before anybody can become a creative designer or a technical prepress person, the graphic communications industry may need to realize that appropriate training is required for students to become successful.

> There is as big a difference between these applications and the QuarkXPress and Adobe GoLives of this world as there is between the people who depend on these template-driven solutions and the design professionals who understand that true design is much more than just printing it without typos. Don't get me wrong, some of these applications can complete very complex projects, but that's not what they are designed for. These applications are designed to give individuals with little or no experience in graphic design the tools to format a page and print it out.

> In the next few years small printers, in particular, will be even more burdened with projects created on these low-budget applications with delusions of grandeur. These printers are already struggling to produce these projects at all, let alone providing some measure of quality (Watterson, 2002).

Ten years ago the occupational areas were clearly defined. There had been very few changes for many years, even decades, and were often considered lifelong careers. In the last ten years, we have seen six occupational areas in the graphic arts industry completely eliminated, two occupational areas absorbed into other career paths, and two new occupational areas have come out of the technology revolution. Because of these changes, it was the goal of this capstone project to either prove or disprove that the graphics department faculty and administration had adjusted to the changing technology and that the curricula were up-to-date with current occupations in the industry.

As faculty in an educational institution, and living in a world of continually changing technology, we must continue to evaluate the life span of an occupation, not for just five years, but long into the future. Because the life of an occupation might only exist for a few years, we have to prepare our young people to understand that they will face changing occupational areas within their lifetimes.

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Cross-Media Publishing: Implications for Graphic Communications Education

John Craft, Ed.D. & Thomas H. Spotts, Ph.D.

Introduction

Many changes and shifts in technology have impacted the graphic arts industry and graphic arts education. As recently as 15 years ago, the emphasis in the study of "Graphic Arts" was process photography. The reliance on photographic film processing was necessary for typesetting, producing negatives of typeset copy and photographic prints for image assembly on photosensitive plates.

During the 1960s, educators were faced with the shift from traditional hot metal typesetting to the cold type process and the process of imaging photosensitive plates. Ultimately phototypesetting—which was mostly computer driven—became the dominant process for producing type from the mid-1970s until the late-1980s. The down side of phototypesetting for graphic arts education was the expense of the system which limited the number of workstations and the corrosive chemicals required to process the photographic paper.

The gradual digitization of the graphic arts processes during the mid-1980s minimized the need for film-based media. Commercial printing companies were forced to work with customers that would have digital files created from their (the customer's) personal computer—the reliance on film began to diminish.

Computers have become a dominate force in the industry and as such the preferred tools for graphic arts education since they are more affordable as workstations when compared with the offset duplicator or the phototypesetter. Since 1984, with the introduction of Apple Macintosh computer and shortly after in 1985 with the introduction of Aldus PageMaker desktop publishing program, schools started to make use of the desktop publishing technology to produce internal publications such as yearbooks and newspapers. Before computers and desktop publishing software, most schools would work with a yearbook representative or an advisor to prepare text copy and pictures. Everything would be sent to a printing plant where a production specialist would make sense of the instructions and translate them into a form for printing reproduction. Yet, most of the production job was not in the hands of the customer but controlled by the commercial printing companies. Graphic Arts Programs in schools could also focus only on prepress and justify the elimination of production equipment, greatly diminishing the effectiveness of printing programs in secondary education. As such, computers have become the preferred tools for graphic arts education since they are more affordable as workstations when compared with the offset duplicator or the phototypesetter.

It was with the implementation of desktop publishing—the production of page layouts containing photographic images including the use of process and spot colors, that files were managed from the customer's computer. However, this was not a perfect scenario. A new source of problems became apparent from using desktop publishing technology. The most bothersome problems included missing fonts, and broken links from image files to page layout files. To correct problems generated by page layout files necessitated the teaching of preflighting as a component of Graphic Arts/Communications Education.

Other issues associated with desktop publishing included the production of "laser crud." This problem would occur when what looks great on the computer screen looks horrendous on the laser output. "What You See Is What You Get" (WYSIWYG) was not always true with desktop publishing technology. Spacing problems and font substitutions contributed to jobs that appeared poorly constructed. Students may have understood the mechanics of preparing a page layout containing picture graphics, but the use (or overuse) of type fonts and styles, improper spacing continue to cause ineffective page layout designs. The promise of preflighting is to identify problems with the layout before it goes into production.

As desktop publishing became acceptable by commercial printing companies, another computer phenomenon appeared during the mid-1990s. The introduction of the World Wide Web by Tim Berners Lee would also have an impact on Graphic Arts/Communications courses as well as commercial printing businesses. As noted by the World Wide Web Consortium "The Internet provided a foundation for the World Wide Web. The National Center for Supercomputing Applications (NCSA) released the first alpha version of Marc Andreessen's 'Mosaic for X'—which later would become Netscape. Web pages are created in Hypertext Markup Language (HTML)" (http://www.w3.org/History.html).

Now we are potentially on the verge of another transition in the graphic arts industry and graphic arts education. The introduction of a phenomenon called cross-media publishing has industry and educators wondering whether it will change the way we think about

traditional publishing and graphic arts/communications education. However, before questions of this nature can be addressed, one needs to know what cross-media publishing is.

There are a variety of definitions available in the literature for cross-media or cross-media publishing, but most imply that it is creating content once and publishing, or distributing, it through a variety of media channels such as print, CD, web sites, wireless devices, etc. This means converting text and graphics for multiple uses such as: a brochure; a web site, wireless device applications or even output to a screen at the grocery store checkout. This doesn't mean taking a page layout file for a brochure and reformatting it for each media device–though it can be done this way. Generally, this implies using a common format content for all output and not having to repurpose. Sounds great, doesn't it?

Reading about new innovations/technologies in trade journals is one thing, but this does not always represent what is happening in the industry most closely associated with education, that is on a local level. Pondering this problem and wondering what industry thought about cross-media, the authors decided to examine cross-media publishing a little closer. During the Summer and early Fall of 2002, the authors conducted a brief questionnaire to better understand cross-media publishing and see what industry thought about it.

Questionnaire Design

A questionnaire was developed in consultation with Kenneth Spears, Editor of Cross-media Publishing trade magazine and Rick Bright of Live Wire Graphics, a company that offers cross-media publishing as part of their services. Twelve questions were composed from the information gathered from the editor and the manager who were involved in cross-media publishing. The researchers conducting the inquiry decided to use a web-based form so that responses could be generated more expediently than by regular or what is know as "snail mail". The design of the questions was open ended to allow respondents to provide reactionary statements or opinions about the research topic.

Researchers selected participant names located from the PressTek (http://www.presstek.com) digital printing directory and an educational organizations membership list. This was a starting point for the researchers to establish contact with potential practitioners of cross-media publishing. The selected parties were contacted by telephone and those agreeing to participate were instructed to go to the following URL: http://faa.appstate.edu/research/tech/media.html. Figures 1 and 2 show the Web page design of the questionnaires used for this research. By going to the Cross-media Questionnaire Web site respondents were able to answer the questions posed by the researchers.

The respondents represent only a small cross-section of selected industry representatives and educators so caution should be exercised in interpreting the findings. Generalizations to a larger population should not be made.

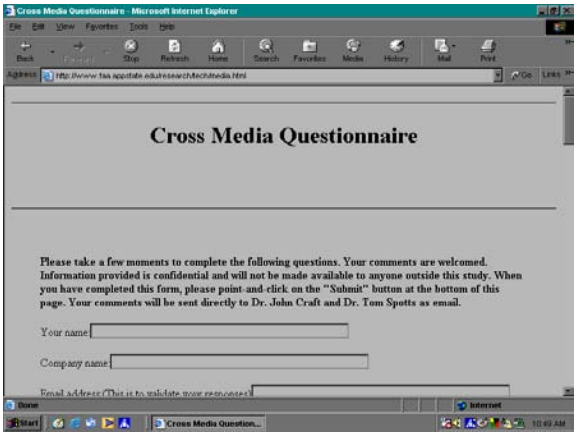

Figure 1. The Web-based questionnaire form as it appears to respondents from a Web browser.

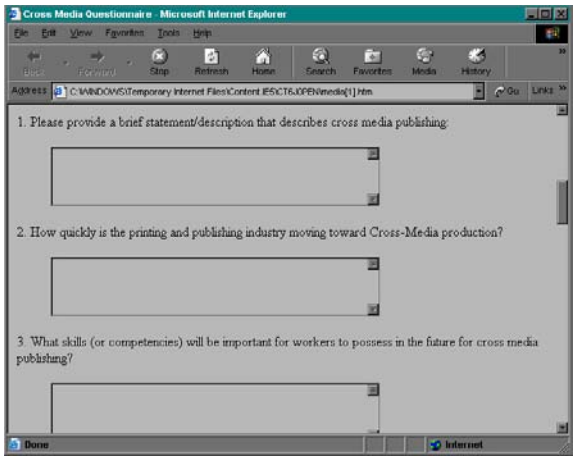

Figure 2. This illustration shows the text fields that participants would type their responses.

Questions, selected opinions, and results from the Web-based Questionnaire

Opinions from the respondents were collected from E-mail messages. This section includes the questions, selected comments from the participants, and brief statements on the comments.

1. Please provide a brief statement/description that describes cross-media publishing.

When asked to provide a brief statement or description about cross-media publishing, 80% of the participants were in agreement that cross-media publishing is creating

the content once and then reproducing it in more than one media. The content could be in the form of text and images. The remaining participants were not sure how to describe cross-media publishing.

Jesus Rodriquez (Professor of Graphic Communications, Pittsburg State University) indicated that cross-media publishing may have started with newspaper production— "newspapers have been using some of this technology for some time."

2. How quickly is the printing and publishing industry moving toward cross-media production?

The purpose of this question was to determine how much progress has the printing and publishing industry made in implementing cross-media production workflow as a service option for their customers. Most of the respondents (60%) indicated that the transition to cross-media production is a slow process. The reason for the slow transition to cross-media production was not clearly indicated by the respondents. Their opinions from this question varied due to the their association with the printing and publishing industry. Kenneth Spears offered the most optimistic view in response to Question 2 by stating "It is here. 99% of the graphics professionals I have talked to in the last year create for more than one media."

Others stated that cross-media production is customer driven to print-on-paper. However, customers requesting cross-media service continue to increase as noted by Rick Bright (manager of Live Wire Graphics). Bright commented— "It depends initially on current customer demand for this service which is small. But also on our ability to anticipate our clients needs before they know they have the need."

Others that were questioned indicated that variety of services is related to cross-media production— "My Company now gears our sales efforts to become one source for our clients needs, we offer a wide range of services under one roof."

Jerry Waite (Professor, University of Houston, Texas) commented on the status of cross-media production in Texas— "Dragging their feet as long as possible— especially in Texas. The 'ostrich' syndrome."

3. What skills (or competencies) will be important for workers to possess in the future for cross-media publishing?

Through this question researchers received opinions about respondent's perceptions of skills that were considered most important. Most of the participants agreed that workers would have to posses a wide variety of skills beyond those that are core for desktop publishing. Those indicated were: computer graphic design, photographic development, marketing and problem solving skills.

4. What other skills can you think of that would prepare college students for the business or employment in cross-media publishing?

The identification of skills necessary for cross-media publishing generated a variety of responses. Business skills such as marketing were strongly recommended by 70% of the respondents. One of this group believed that graphic arts/communications students should understand what causes low profit margins and by taking accounting and other business courses, this skill could be acquired.

Twenty per cent of the respondents believed that communication was the most important skill students should acquire. One respondent believed that skills in printing, Web design and large format capabilities, knowledge of the best media for each application were most important skills.

An educator pointed out that students should "understand the unique niches of each media and how to exploit those media to get the client's point across pointed it out. Also, graphic arts/communications students must know how to deal with change and how to make change happen."

Kenneth Spears elaborated by saying that students should "take classes in marketing. Take classes in social behaviors so that you can understand how people think in groups and market materials accordingly. Also, classes in the effectiveness of various media are critical. Do baby boomers watch MTV, most do not. So understanding the nuisances of the audiences is critical to a successful cross-media marketing effort.

5. If you were given the opportunity to design a course in cross-media publishing at the university level, what do you feel is the most important objective for students to achieve upon completing a 15 week semester?

Ninety per cent of the respondents were in agreement with the study of media as being most important.

The following comments were indicative of expectations for a course in cross-media publishing:

"Making sure they have a solid foundation of computer graphics and how cross-media publishing is ultimately accomplished."

"What each form of media needs to be in to be able to be published, i.e., resolution, bandwidth, compression... and how to achieve it. Basically the technical stuff."

"Understand the needs of the customer. Then figure out how to deliver solutions."

" To develop an awareness with in-depth understanding of the application of cross-media publishing and how it relates to the traditional form of publishing."

"Understanding various media and the effects of integrated marketing campaigns to boost market share of a given product. This coupled with the technical knowledge to produce content effectively and cheaply."

" Human factors: how well does the human interface work...can people get the information they need as easy as possible. Does the design of the interface make it easy or hard to access information?"

6. Do you think that students can learn about cross-media publishing from off-the-shelf software packages?

Most representatives of companies discussed some of the software that would be useful for students to know.

"Just how to manipulate the content they are creating or using. The real work comes from understanding how the content will be used. Too many of today's graphics people lack a basic understanding of print, which require the highest resolution of content and can be a great foundation for all other media, including video."

" Not a single one, but a suite is necessary. The big issues are not software ones, but design-related. What does it look like, how is it organized, how can people find things, what do the people want to know?"

7. Are there effective off-the-shelf software packages you feel would adequately prepare students with skills in cross-media publishing?

When asked about the most effective software to prepare students, 40% indicated they did not know or weren't sure. The remaining respondents offered either specific software programs or gave a general answer of a software company that makes the type of product used in the preparation of content.

It became apparent from this question that the participants are implying software knowledge is important and the student would have a working knowledge of the software tools of the industry. This also implies that the dominant definition of cross-media in this survey is more the concept that one should be able to create the content once in one type of format and use it in all media distribution channels.

8. What core skills should students learn or have to prepare for a career in cross-media publishing?

" Awareness of printing and publishing, awareness of basic layout and design, awareness of basic web site design, and awareness of the choices that are available in the form of software."

"How to listen to customers."

"A print background will help in the graphics end. Marketing and business in the planning of a cross-media ad campaign. The key to all of this is common sense. Students need to ask themselves, if I see this ad on the Internet, in print or on television, what is going to influence my purchasing decision. Or do all of these media bring a true legitimacy to the product and that makes me want to buy?"

The responses to this question were interesting. The questions immediately preceding this focused on the importance of software and the technical aspect of cross-media publishing. The responses to core skills needed to prepare for a career in cross-media were weighted in other areas. Only 30% focused on, or included, computer/technical skills. At least 70% also emphasized the importance or people skills, problem solving skills, business knowledge, and knowledge of printing/publishing. This implies that skills other than technical/software are also of great importance in cross-media.

9. Can there be a truly media-neutral approach to publishing (please explain)?

" Depends on the scope and purpose of publishing. Neutrality is in the eyes of the beholder."

" I don't believe so. There is no one set of media that will accomplish absolutely everything on every project. It is important to understand what the options are and what their benefits and limits are."

" No. It is so hard to make a connection with potential audiences that each publication must be tailored to fit the media. That is what makes cross-media publishing tricky. The best advice, keep the message simple and direct."

Question 9 asks whether there can be a truly media-neutral approach to publishing. The origin of it is from an article that talked about content mastering in the recording industry and how this might be an approach in cross-media. A neutral content is created and extra work to enhance or adjust the content is made depending on where the content is directed. Hence page layout etc. is relegated to the print area in the backend of the production.

This question should probably not have been included because it assumes participants:

1. Understand the cross-media concept
2. Understand media neutral
3. Can apply these concepts to what we are discussing.

If cross-media publishing is create once, use many times, then how content is created and stored will need to change. Currently we create for print, change for web, change for video broadcast, etc. The true followers say this is repurposing, and that cross-media would allow us to use the once-created content in all media channels. In fact, some have said that cross-media is not repurposing.

10. Do cross-media publishing systems currently exist?

"If you mean a standard or rules, not to my knowledge. The graphic arts software claims they have it, but they usually mean they can turn a print ad into a web page."

Kenneth Spears indicated "Yes. The list is very long and there are different solutions for different things. Newspapers and publications have certain needs and Internet needs are still different. The key is understanding the overall objective of the project and the goals that need to be achieved."

On this question, most were saying no or not sure. This implies that while we are free with defining the concept, technology has no kept pace. 20% of the respondents firmly said no, while 70% answered vaguely that they were not sure, did not know, or somewhat. Only 10% answered firmly yes, however qualified the answer that there are different solutions for different areas, which makes me think that if the create once concept defines cross-media, this answer implies no in reality.

11. Does the definition or application of the term cross-media differ for advertising to newspaper publishing; or commercial printing to direct mail, etc?

The purpose of this question was to see if the respondents saw differences as to the definition of cross-media.

"The way I understand it, no. The idea of cross-media goes beyond print to PDAs, the new m-life and Sprint cell "phones," and so on. It's providing the same core information with a variety of media--while exploiting the characteristics of the media."

"To my mind, cross-media refers to more than traditional print, but print to web and video, & also to music & information. And what about video games to movies to comic books to DVD and radio airplay of the soundtrack."

When asked if cross-media meaning differs across different areas (printing/publishing, newspaper, advertising, etc.), respondents were relatively even split between yes and no. 40% of the respondents sided with no or don't know, while 40% implied yes that it does vary across disciplines. The remaining 20% replied that they did not understand the question.

Advertisers and some printers talk about cross-media publishing as just doing the same product campaign with the same content in several different media formats. For example, a product may have an advertisement in newspaper, direct mail, on radio and television, plus be on a Web-site, but the content is prepared individually for each campaign. To some, this is cross-media publishing, but others say this is repurposing. True cross-media would be the development of content once (in one format) that could be used in all media, i.e. print, Web, wireless

12. What standards will be necessary for cross-media publishing? This might include information about content, such as file names, relationships between files, attributes of files, things that make data easier to use across-media or platforms (from editor/publisher article).

The purpose here was to obtain opinions as to whether cross-media would require standardization for graphics, fonts, etc. to enable different media systems to utilize the content easily in their format and eliminate cross-platform problems, software-to-software translation difficulties, etc. Does there need to be a generalization?

"All of the above are important. All media should be designed to be accessible to the lowest common denominator. (e.g. don't design an intricate Flash web page that can only be accessed through a T1 line when your audience is 19-25 year olds and their primary Internet

connections are dial-ups. The page will take 25 minutes to load and they will move on to another web site.) The same types of standards necessary for traditional publishing will be necessary for cross-media; it's important to keep things homogenous between mediums."

" XML (eXtensible Markup Language)seems to be how cross-media publishing is done. It's important to understanding the difference between html (data display) and xml (data description) and how they are created to work together."

" The only standard is that solutions need to fit a particular need or goal. XML imposes standards as does PDF. Because there are so many variables, an overall cross-media standard will be hard to develop.

Content has to be tagged identifying descriptions of the content for the intended use in which media it is going to be distributed. A definition file might be necessary describing the necessary changes to the content to make it work in the different media formats. Would tagging need to be arranged in a specific order or standardized arrangement, like type then graphics, etc. ? What would be file formats for the graphics, color information, etc. ?

Conclusion

The purpose of the questionnaire was to seek opinions from business and education professionals about cross-media publishing. It is necessary to determine what is known and to gain a better understanding of cross-media in order to develop questions for a more rigorous study of cross-media and its implications for the graphic arts industry and education. The results of the questionnaire did reveal several implications of interest from educators and printing industry representatives, which are listed below.

1. The inclusion of cross-media publishing/production as a curricular content is of importance to graphic arts/communications curriculum.
2. Specific skills should be addressed in graphic arts/communications courses to prepare students with cross-media publishing experience.
3. The sophistication of hardware and software design increases the capabilities of these tools to do cross-media publishing.
4. Cross-media production is defined as the application and management of digital content for the distribution through various media—ink-on-paper printed production, World Wide Web, Personal Digital Assistant (PDA), CD-ROM, cell phone, or any electronic device capable of processing eXtensible Markup Language (XML) files.
5. Leading commercial software vendors such as Adobe, Macromedia, and Quark, provide cross-media publishing resources and tools for cross-media file production.
6. More extensive research is needed to determine from a large population of commercial printing companies the level of importance the study of cross-media publishing has as a course of study for graphic arts/communication education.
7. The study of XML should be included in the study of cross-media publishing.
8. XML is highly important as a means for cross-media production.

While this only represents the opinions of a small group of people, it does indicate questions that should be asked in an expanded study. A more in depth study of this nature (perhaps using directories from the Printing Industries of America) should be done to determine how cross-media publishing will impact graphic arts education in the future.

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Integrating AppleScript into Graphic Communications Curricula

Klaus Schmidt, Ph.D. & Daniel G. Wilson, D.I.T.

Introduction

College students majoring in Technology or Graphic Communications-related fields are typically not required to take a computer-programming course. However today, with the pervasiveness of computer applications across almost all fields, a greater need to understand programming languages and concepts may be required. Many modern computer applications and operating systems allow for users to customize certain components using open source code, leading to much greater productivity. However, programming skills among graduates in areas such as Technology and Graphics Communications, are limited. It is the position of the authors of this work is that graduates of Graphics Communications programs will benefit greatly from acquiring the skills necessary to customize and automate their computational environment to a level with which they can make their organizations more productive and effective.

AppleScript, long a component of Apple computers, has been developed to address open source coding/programming in the Apple/OS environment. Since its introduction in the late 80s, AppleScript has been a language that provides the potential for automation in graphic arts workflows. Thus, it may be time to incorporate more AppleScript content into graphic communications curriculum, creating graduates with higher demand in the Printing and Graphics Industry.

The following discussion targets graphics communications educators who would like to incorporate AppleScript into their curricula. Since available instruction time in programs, as well as instructor knowledge may vary tremendously from curriculum to curriculum, the authors present three different curricular scenarios, each at a different level of detail, as a suggested guide to integrate AppleScript knowledge and skills into graphic communications programs. The first scenario introduces AppleScript in a one-week session out of a typical college course, providing an overview of AppleScript capabilities and terminology. The second scenario, which is suggested to require four weeks out of a typical college course, will build on this one-week session, adding content on the existing AppleScript components required to customize computational environments. The third scenario, requiring eight weeks, adds more depth to the discussion of AppleScript components, providing a first insight into modifying existing source code, or scripts, pertaining to operating systems and applications and moving toward mastery of programming AppleScript components.

The One-week Curriculum

This module is designed to introduce the basic features of AppleScript, and to make students aware of application and implementation of AppleScripts in graphic media environments. Time required might include two one-hour lectures and one three-hour lab.

One-week curriculum content outline:

I. AppleScript
  a. The Script editor
  b. Opening and examining Scripts

II. Using scripts
  a. Finder scripts
  b. Info scripts
  c. Internet scripts
  d. Navigation scripts

III. Types of AppleScripts
  a. Script Files
  b. Applets
  c. Droplets
  d. Toolbar Scripts
  e. Script Menus

Explanation of one-week curriculum

Apple OS provides a number of scripts that have become a part of the basic Mac OS X installation. Additional scripts have become part of other applications. Nevertheless, all of these existing scripts can be examined and modified in the script editor, a utility that is part of the Macintosh OS installation, and can also be executed as separate applications. Some of these scripts include 'Finder Scripts', 'Info Scripts', 'Internet Services', and 'Navigation Scripts'. The 'Finder Scripts', for example, rename selected files in the active window or on the desktop, while 'Info Scripts' may display information such as current date and time. In addition to those existing scripts, users can download free scripts from the Apple website (http://www.apple.com/applescript). Students can be introduced to efficiently search for downloadable information and demonstrations that help them to understand and apply existing scripts.

Next, students learn about Script Files, Applets, Droplets, Toolbar Scripts and Script Menus. Defining and understanding these concepts is essential to moving toward writing AppleScript code for various purposes.

The Script Files contain the text that the programmer has entered via a Script Editor. These files can be opened by any application that is capable of reading text. The text files need an extension in order to be compiled and executed. The compiled file will obtain an extension of .scpt. Double click the .scpt file to edit.

Applets are commonly used in application and web development environments and are small application programs that run when double-clicked. These applets can also be opened in the script editor for editing purposes. However, to prevent users from modifying the script, the file should be saved as a run-only application. This will save the compiled script and remove the text.

Droplets are more sophisticated Applets in that they are activated when files and folders are dragged and dropped onto them. The droplet is then executed/launched and does whatever it was designed to do with the file or folder that was dropped onto it.

Toolbar scripts allow customization of the toolbars using the Customize Toolbar command in the View menu. Compiled scripts, applets and droplets can be placed in the toolbar.

Script menus are closely linked to the Operating System. Apple ships its OS with a number of great scripts. However, users can modify them as they become more familiar with the OS over time.

Once students have acquired a thorough foundation of above concepts, they can move on to a more in-depth study of AppleScript components and scripting in a four-week module.

The Four-week Curriculum

The four-week curriculum builds on what has been learned in the one-week curriculum. However, a four-week session will provide a deeper insight into AppleScript and its components as a programming language. It will allow students to understand more AppleScript terminology and concepts and actually apply existing AppleScripts in a meaningful and effective manner. An understanding of this information would be necessary to effectively modify existing scripts. Time required might include eight one-hour lectures and four three-hour labs.

Four-week curriculum content outline (all of one-week curriculum, plus):

I. Defining object-oriented programming
   a. Events
   b. Parameters
   c. Modifiers

II. Application-support
   a. Open-application event
   b. Open document event
   c. Print event
   d. Quit event

III. Basic architecture and terminology
   a. Classes
   b. Commands
   c. Suites

Explanation of four-week curriculum

In a four-week session, students learn that AppleScript uses a syntactical approach to programming. In an object oriented programming environment, this means that events (such as a click or a double-click event) trigger the code that should be executed. For example, if a script is written that turns the background color of a document from white to yellow, the event is the click of the mouse on an object (such as a command button) triggering the script to execute the code and change the color. Furthermore, an event may have parameters, which can be defined as modifiers for the command or code to be executed. For example, a parameter could define the number of records in a database to print, or the number of images to be opened for display. So when the user in our previous example clicks with the mouse on the command button to change the background color of the document (the event), a dialog box could be displayed asking the user to select the color to which the background of the document should change (the parameter).

Basic architecture and terminology is another important piece of information about AppleScript that should be included in the four-week session. The basic AppleScript architecture and terminology include defining and differentiating (1) classes, (2) commands, and (3) suites. A suite is a collection for syntactical or code elements required for specific types of tasks. For example, the 'table suite' can be used to create tables for databases or spreadsheets. Each suite contains a number of syntactical (or code) elements specific to its function. Classes and commands are the two types of elements that are most important and apply to all suites. Classes are the tools that create the objects that the suite will interact with. For example, in the 'text suite', the text itself is an object that may have characteristics like 'character', 'word', and 'font', among others. These characteristics are defined by the class and are called 'properties'. Commands, on the other hand, are defined by their function and by what their parameters are. For example, the command could be 'save', and the parameter could be 'filename' and/or 'file format' for a saved file. An analogy is that a class can be characterized as a noun, whereas a command can be classified as a 'verb'.

Students next learn about Application Support. This includes four basic Apple events: (1) the open application event, (2) the open document event, (3) the print event, and (4) the (application) quit event.

The eight-week curriculum

This session will build upon the knowledge acquired in the four-week session, and in addition enable students to customize existing AppleScript components using syntactical concepts and code. It includes familiarizing students with the basic scripting features to efficiently modify existing scripts, and to syntactical concepts such as (1) constants and variables, (2) loops, and (3) conditional statements. Also, basic programming concepts including the employment/creation of block and handlers would be introduced, providing the foundation for students to create their own scripts. Time required might include sixteen one-hour lectures and eight three-hour labs.

Eight-week curriculum content outline (all of four-week curriculum, plus):

I. AppleScript Syntactical Concepts & Code
   a. Constants & Variables
   b. Conditional statements
   c. Control structures (loops)

II. Blocks
   a. Subroutines
   b. Handlers

Explanation of eight-week curriculum

A constant holds a set value in memory. AppleScript provides a number of constants such as 'true', 'false', 'pi', and many date/time constants such as 'Saturday', 'hours', and the like. Variables, on the other hand, are values in memory that can be changed, and therefore are not fixed like the constants. The change can occur via user input, or simply through programming requirements. In AppleScript, variables are used to store data. One advantage of AppleScript is that one does not have to explicitly declare a variable-- one can simply 'declare' it by using it. For example, if one wants to create a variable one can simply use the following syntax:

```
set myName to "Klaus"
```

The statements 'set' and 'to' are AppleScript syntax, 'myName' is the variable name (which could be any name), and the word "Klaus" will become the value of that variable. So AppleScript syntax will not expect to explicitly create/declare the variable first, before it is being used. The concept of variables becomes of particular interest when we talk about classes in object-oriented programming. Classes, which are the tools used to create objects, do have properties. The properties, such as 'fontsize' or 'fontstyle' are created using variables, since the value of these properties may change. For example, fontsize = 12 could be changed to fontsize = 14. Using a variable to create properties for a class makes perfect sense and is germane to object-oriented programming. Students will now be ready to understand that creating a property for a class is done by declaring a variable. The correct syntax uses the 'get' and 'set' statements:

```
Get the title of calendar 1  'gets the (title)property of
the (calendar)class

Set myTitle to the title of calendar 1 ' sets the
(title)property to the title of calendar 1 and stores it so you
can use it later to change the value (myTitle is a variable
that the programmer created).
```

The preceding discussion is related mostly to the Apple OS application environment. However, in an eight-week session, one should include more thoroughly the syntax for programming in general. This will enable students to not only customize applications, but also the operating system environment. An application-independent syntax involves writing programs using AppleScript that are not directly linked to any specific Macintosh OS application.

One useful concept when developing programs is that of control structures. Control structures enable the writing of code that can be executed multiple times (using loops), without repeating the command. This code can be used to make decisions (using conditional 'if' statements), or code that may test if a certain condition is true. These components of code are usually structured into blocks. These blocks are often referred to as 'handlers', in particular when they are linked to a specific event. For example, one could create an error handler, which is a piece of code that will be executed if a specific error occurs. Conditional statements are necessary to enable a program to make decisions based on conditions. For example:

```
Set theAge to (current age) as number     'creates and
sets theAge variable to a number datatype
If 13 – 19 is in theAge then
        Display dialog "You are a Teenager"
Else
        Display dialog "You are not a Teenager"
End if
```

One can also use multiple 'elses', depending on the decisions required:

```
If 1 – 12 is in theAge then
        Display dialog "You are not a Teenager yet"
Else if 13 – 19 is in theAge then
        Display dialog "You are a Teenager"
Else
        Display dialog "You are no longer a Teenager"
End if
```

The next concept, Repetition (or loops) will rerun a certain portion of code multiple times, based on the type of loop one uses. AppleScript has six types of loops, including

(1) repeat forever, (2) repeat x times, (3) repeat while, (4) repeat until, (5) repeat with/from/to, and (6) repeat with/in.

'Repeat forever' will repeat a certain portion of code an unlimited number of times. This loop is used to rerun some code until something specific happens. For example, code may need to be repeated until the user enters a disk into the disk drive, at which time the loop will exit.

The 'repeat x times loop' runs a predefined number of times, for example:

```
Counter = 5
Repeat counter times
'statements in loop
end repeat
```

This type of loop is commonly used when one knows exactly how often one wants to run the statements inside the loop. For example, this loop might be used to print a predetermined number of records in a database table.

The "repeat while loop' is a type of loop that is combined with a conditional statement. As long as a certain condition is true, the loop will be run, once the condition becomes false, the loop will be exited. For example:

```
Repeat while x < numberofrecords
'statements inside of loop
x = x + 1
end repeat
```

If numberofrecords is 20, the loop will be run as long as x is less than 20.

The x = x + 1 increments the x by one in order to move on and test the next x versus the condition. Assuming the first x to be 1, the second would be 2, the third 3, and so on. Once x equals the content of the numberofrecords variable, the loop will be exited.

The 'repeat until loop' is similar to the 'repeat while', with the exception that now a condition can be tested to be false. When the condition becomes true the loop is exited. For example:

```
Repeat until x > numberofrecords
'statements inside of loop
x = x + 1
end repeat
```

Once x is greater than numberofrecords, the loop will exit.

There are other types of loops that AppleScript provides, but for the 8-week session, coverage of these basic loop styles will suffice. Remaining loop concepts can be included in the eight-week curriculum.

AppleScripts provides a structure based on three principal programming concepts: 'Blocks', 'Subroutines', and 'Handlers'. A block of code is a set of lines executed one after another unless some variation occurs as a result either of an error or of a test carried out during the block of code. In AppleScript, blocks of code start with either a 'tell', an 'on', or a 'to' statement and ends with the word 'end'. Example:

```
tell application "Finder"
                        Count the windows
                        End tell
```

There are two types of blocks that students should understand, (1) subroutines and (2) handlers. A subroutine is a block of code that, when executed, runs a very defined and specific routine, most likely linked to some event, such as a double-click. For example, if you want to calculate the area given width and length, you can accomplish this as follows:

```
On area given width:w, length:l
        Return w * l
End area
```

Due to the flexibility of AppleScript you may also write:

```
On area(w, l)
        Return w*l
End area
```

Both scripts will calculate the same thing and come to the same result. However, it is sometimes easier for the beginning programmer to stick to the first choice of syntax since there one is not confined to enter the parameters a certain way (e.g, first enter w, then enter l). With the second choice, one would have to enter the w first, and the l second.

Parameters make AppleScript more flexible and easy to use. There are a number of prepositions that come with the parameters in AppleScript. A preposition precedes a parameter for further refinement. The prepositions one can use are: about, above, against, apart, from, around, aside from, at, below, beneath, beside, between, by, for, from, instead of, into, on onto, out of over, since, thru, and under.

Handlers are also subroutines, but with one unique difference. While subroutines are commonly associated with a certain command, the code in a Handler is invoked when AppleScript chooses to do so (e.g., when an error occurs in the sub-routine, the sub-routine is exited and an error message appears – error handler). AppleScript contains four basic handlers: run, quit, open, and idle. The run handler makes your code easier to read, but does not have any other major consequences. The run handler will come up with a dialog box that asks you to either run or quit an application. The open handler is invoked whenever a document, folder, or other objects are dropped on a compiled script. The open handler is useful to distinguish between an applet and a droplet. The droplet has an open handler whereas the applet does not. The idle handler allows for the applet or droplet to remain open even though the code at the end of its open or run handler has been executed. Thus, the script keeps running and can wait for further input. The quit handler is launched either through user input, or when the script is finished running. This handler allows you or the user to exit the script.

Programming Concepts

Like any modern programming language, AppleScript contains ways to create conditions, write loops, and check for errors. The syntax, however, is more so than in many other languages closer to the spoken English. This is not necessarily easier, but it gives the novice learner a quicker and smoother transition into the world of programming languages.

In an eight-week session, the curriculum could engage deeper into previously discussed programming concepts. For example, a more thorough discussion of AppleScript variables could be included. AppleScript allows for four types of variables, depending on their scope: variables, globals, properties, and locals. The scope of a variable implies where it was created, and how it can be used. If a variable is declared outside of a handler, the scope/or lifetime is larger than the one that was created inside the handler. Variables created outside the handler are either global or properties, depending on their purpose. Variables declared inside the handler are locals. Local variables can basically only be used within the handler/ sub-procedure in which they are created. Global variables or properties can be read and understood from the entire script, from all sub routines and handlers. For example, if you want to calculate the commission for all your sales staff, you may have one local variable for an individual sales person's commission. Now you want to add this person's commission to the commission of all other sales people on your staff. In order to accumulate all those sales people's commissions, you may create a global variable that is capable of being used outside the sub-procedure.

The last feature to be discussed in the eight-week session is the concept of Try Blocks. These have become very popular in most object-oriented programming environments. The Try block is in a way a conditional statement that expects 'error free execution' of whatever is inside of the Try block. If an error occurs, the statement inside the 'on error' clause is executed. This type of syntax helps to quickly identify what the cause or type of the error might be, and how a quick fix of the program flow may be possible. Here's some syntax as an example:

```
try
        --read a record
on error number errnum
        if errnum = 39 then
        exit repeat
        else
        display dialog "error reading file"
end if
end try
```

Summary

Graphic Communications educators teaching applications and workflows in a Macintosh environment may wish to explore integrating AppleScript into their curriculums. While advanced AppleScript use requires an understanding of programming concepts and techniques and requires much time to develop, students can learn to use existing AppleScripts to make their work more efficient and effective in a much briefer time frame.

The authors of this article have outlined three curriculum levels that educators may wish to use as models to integrate AppleScript concepts and skills into existing courses. The first level would require about one week, depending on the structure of the course and would introduce students to what an AppleScript is and how to employ it in work situations. The second level would require about four weeks and would provide students with a foundation in understanding AppleScripts and enable them to explore the modification of existing scripts. The third, and most advanced level would require about eight weeks and would provide a foundation in AppleScript programming. Students at this level would have the ability to build on their knowledge and begin writing customized AppleScripts. These skills would undoubtedly make a graduate more desirable to any employer looking to increase productivity in their premedia production areas.

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PDF Works Online: If You Use It, Do It Right

Thomas Tyberg, M.A.

Introduction

The use of Portable Document Format (PDF) files on the World Wide Web (WWW), or other Web-based applications, brings an interesting discussion to the forefront on the usability of this file format. There is a disagreement between some Web usability experts (PDF opponents) and proponents of PDF files as to the suitability of their use as an online document format. Jakob Nielsen stated in his June 10, 2001 Alertbox that "PDF is great for distributing documents that need to be printed. But that is all it's good for" (Nielsen, 2001). While Robert McDaniels, a business analyst, from Adobe Systems, Inc., counters and indicates that "most PDFs are created from documents meant for print, and posted to the web to allow users instant access to these materials. This, however, does not have to be the case" (McDaniels, 2003).

The implications of this discussion of PDF usage online are important for those embarking on using PDF in online courses, Web page content, and even general usage. PDF users should be sure the files are converted and designed in a manner that will provide the most benefit to the provider and user, whether in an educational environment, business environment. This article will touch on the development of PDF documents and standards. It will also take a look at some of the points of contention between proponents of PDF and those detractors that would relegate PDF files to the "print-only" pile. Finally, it will present some practical research relating to online use of PDF files, review some usability guidelines for the Web, and provide some recommendations for the use of PDF files online.

Development of PDF Documents

According to Lau (n.d.) PDF files are "universal documents" and "electronic versions of paper documents" with reduced file sizes that are supported by more than 6 computer operating systems from Windows to Mac to Linux to Palm and are therefore "platform independent." Perets (2001), of Microtype indicates, "PDF is a versatile file format, with diverse uses. Many use it for print/press purposes, but others use it for visually-rich interactive documents, multimedia, forms, image-based catalogs, and other purposes."

Development of PDF began in 1991 when John Warnock, a co-founder of Adobe Systems, Inc. described Portable Document Format (PDF) files in a white paper. He described it as a "universal way to communicate documents across a wide variety" of operating systems, networks, and machine types (Marin and Shaffer, 2003).

The development of this universal format was based upon Adobe's successful page description language, PostScript. Version 1.0 of PDF was introduced in 1992 at Comdex, and was targeted at the development of the "paperless office." Versions 1.0 and 1.1 of PDF (Acrobat 1. 0 and 2.0) were of little use to the printing industry and of little use online. Version 1.2 (Acrobat 3.0) introduced in 1996 supported more of what the printing industry was looking for, but the format was slow to be adopted by the printing industry. In 1999, as a result of a recognized need by the Committee for Graphic Arts Technologies Standards (CGATS), a printing, publishing, and graphics companies, recognized the need for a standard for digital data exchange (Marin and Shaffer, 2003).

Additional development was carried on with subsequent versions of PDF. Version 1.3 of PDF (Acrobat 4.0) maintained the high-end requirements of the printing industry and the CGATS standards which eventually became an American National Standards Institute (ANSI) standard in 1999 (Marin and Shaffer, 2003). Even so, PDF is still perceived by many, including Jakob Nielsen, as a print only format. According to Nielsen (2003), "PDF is great for one thing and one thing only: printing documents." Subsequent versions, 1.4 and the newest 1.5 (Acrobat 6.0) added new feature that were not specific to the printing industry but have made PDF files one of the most widely used formats for communication. Marin and Shaffer (2003) discuss reasons for the ubiquitous use of PDF files, "because it answers so many needs we've had since we've begun creating and attempting to exchange digital document."

"PDF is the best format to use if you want to preserve fonts and colors of the original document. PDF documents are scalable, render faithfully on all computer screens, and print out exactly as they appear on screen. Not to mention the many design and editing tools that automatically output to PDF format." (Krim, 2003). Being able to view the file on any platform, Mac, Windows, Linux, etc. removes the need for multiple copies of the original layout program. PDF files are also very portable. All elements are in a single document. Perhaps one of the best reasons to use PDF is the ability to embed fonts within the document preserving formatting (Marin and Shaffer, 2003). There is no need to require the student or others to acquire a word processing program like Microsoft Word to deliver content, and version control of

file versions is not required. Besides the original Acrobat Distiller for creating PDF files, there are now many free PDF creation products, among them Open Office and PDF Creator. Other characteristics of PDFs that are important include, the ability to add notes, document optimization, and they open in any browser (Adler, 2000).

Detractors of Online PDF Use

The major detractor of the use of PDF for online documents is Jakob Nielsen. He indicated in his June 10, 2001 Alertbox that PDF files should be reserved for only those documents users are likely to print. Nielsen makes a rough estimate that "forcing users to browse PDF documents makes your website's usability about 300% worse relative to HTML pages." (Nielsen, 2001) Nielsen also feels that users are often "lost in PDF" because PDFs are print-oriented, portrait-style layout pages; that PDFs lack navigation bars or methods; PDFs sometimes crash a users computer, and usability suffers when users are "dumped" into the "non-standard" Web-page format of PDFs (Nielsen, 2001). Krim (2003) also indicates than PDFs often contain large amounts of static text, difficult to read on screen in the traditional format, launch in a separate browser window.

Nielsen again states his opposition to PDF usage online in July of 2003, by pointing out a list of usability problems with PDF files. Among the usability issues stated are the linearity of such documents, PDFs different operating environment, and information flow breaks. He also reiterates the issues of text being formatted to printed pages, computer crashes, and lack of navigation as detracting attributes (Nielsen, 2003). Nielsen points to user dissatisfaction with PDF through comments like "downloading each PDF . . . I find annoying", "on the screen it is hard to read," and "if I bring up PDF, I can't take a section and copy it and move it to Word" as examples of user issues. At first, these appear to be significant drawbacks to PDF usage online.

PDF is a public format that Adobe Systems, Inc. owns. Adobe also defines and publishes the format specifications. PDF can also be too flexible as in high resolution versus low resolution or RGB versus CMYK, or Web-based versus print-based options. PDF is also not the native language of browsers. Mark Anderson (2001), who claims to be, "just a grunt Acrobat user with perhaps more than average user experience" indicates that Jakob Nielsen (2001) "is a bit confused" with PDF terminology and design issues on the Web and that "newbies" may not be capable of generating appropriate PDF documents.

Proponents of PDF Online

McDaniels (2001) responds to Nielsen with a statement, "it looks like what you are really criticizing is bad PDF design, not the PDF format, because PDF actually does all of the things you claim it cannot." McDaniels also admits that PDF was not developed as a native Web format. McDaniels than goes on to cover, point-by-point, the things that Nielsen (2001) indicates PDF cannot accomplish. A review of these points indicates the following corrections to Nielsen's (2001, 2003) statements:

- Linear flow issues are author issues not PDF problems,
- It is difficult to describe crash issues without supporting evidence,
- File sizes can be optimized for a particular use,
- Type sizes are determined by the author, not PDF,
- Navigation in Acrobat/PDF can even mimic browser windows, and
- There are accessibility features available.

In addition, PDF documents support hyper linking, rollovers, bookmarks, thumbnails, and many other specific characteristics attributed to the Web and HTML.

Web Usability Guidelines

Many of the points made by Nielsen are less PDF issues than Web usability issues. The focus on Portable Document Format points away from the actual usability issues. Perets (2001) indicates "it is not that difficult to find PDF files which are badly designed and created." The format should be appropriate for the task being undertaken.

Tony Lopez (2003) of Macromedia, Inc. writes about several steps that should be taken to minimize design issues that impact on Web design and usability. He recounts the experience of redesigning macromedia.com where he is an Executive Producer. He provides four tips relating to redesign. They are a) spend time researching user needs, accomplishments, and goals; b) get help with the areas you need whether it be graphics, design or other areas; c) make changes slowly so that users are not disrupted and you leave the good parts and the problems areas are removed; and d) use the media or technology to fit the situation.

In their newsletter, Roberts & Kay (2001) provide a list of "characteristics of highly usable websites." Use them to help develop your own Web-based environment. The list includes:

- Fast load times,
- Simple and consistent graphic design,
- Short sections of text that are easy to scan,

- A handful of main sections linked from every page,
- Clear and intuitive navigation,
- Accessibility for users who are disabled,
- Black text on a white background,
- Links in blue and visited links in purple,
- A link to Home on every page
- Familiar section names like "contact us" and "about us," and
- No animations or moving text

PDF File Type Research

To look at common characteristics of PDF files, a simple study was developed to look at two characteristics relating to online use of PDF files, specifically file size and the resulting download times. The study was designed to duplicate what a novice generator of PDF files might produce without much attention to the various settings available, using the default settings, in two commonly used layout or word processing programs, Adobe InDesign and Microsoft Word.

The study hypothesis was that file sizes would increase and therefore download times would increase when settings not preferred for online use were utilized in the production of PDF files. Additionally, the study demonstrated how much difference in download time occurred when inappropriate settings were used and what quality resulted from the various PDF file conversion types.

The procedure for this study was to a) save, export or print, a file generated in the software program Adobe InDesign and Microsoft Word Both on a Windows XP machine and on Mac (both OS9 and OSX for InDesign), b) rank order those file sizes, c) calculate the download times for various Web connections, d) compare the results, and f) determine which PDF types provide the quickest download times while providing adequate quality. Additionally, screen captures were made of the various file types for the InDesign documents and then screen captures were made of an 800% enlargement of the file to determine what output quality might result from the particular file type.

Three different original files were used: an InDesign file; and two Word files (one text only and one text and graphics combined). The InDesign file, a laboratory worksheet, contains text and 22 images, and is five pages long. The Word-w/graphics file is five pages long and contains five photographs. The Word-text only a file contains only text, but does contain a table, and is four pages long.

File type	Description for use
Smallest File Size	Used to create PDF documents with minimum image resolution and not font embedding. These files can be opened using Acrobat and Acrobat Reader v5 and higher.
Screen Export	Used to create PDF documents optimized for screen display. Low resolution, 72 dpi. These files can be opened using Acrobat and Acrobat Reader v5.0 and higher.
Standard	Used to create PDF documents suitable for viewing and printing of business documents. Medium resolution.
eBook Export	Used to create PDF documents for eBooks. Includes eBook tags. Medium resolution, 150 and 300 dpi. These files can be opened using Acrobat and Acrobat Reader v4.0 and higher.
Print Export	Used to create PDF documents with higher image resolutions for printing. High resolution 300 and 1200 dpi. These files can be opened using Acrobat and Acrobat Reader v4.0 and higher.
PDFX1a	Used to create files compliant to the PDF/X-1a an ISO Standard for graphic content interchange. High resolution 300 and 1200 dpi. These files can be opened using Acrobat and Acrobat Reader v4.0 and higher.
PDFX3	Used to create files compliant to the PDF/X3 ISO Standard. These files can be opened using Acrobat and Acrobat Reader v4.0 and higher.
Press Export	Used to create PDF documents with higher image resolution for high-quality pre-press printing. Font embedding required. High resolution 300 and 1200 dpi. These files can be opened using Acrobat and Acrobat Reader v4.0 and higher.

Adapted from Adobe InDesign export and print menus (Adobe Systems, Inc., 2002).

Table 1. Description of file sizes.

By using various default settings found in each program for exporting or printing to PDF data was collected for the 8 possible InDesign file types for PDF conversion; Smallest File Size, Screen Export, Standard, eBook Export, Print Export, PDFX1a, PDFX3, and Press Export (See Table 1 for definitions). For Microsoft Word, the possible file types were Smallest File Size, Standard, High Quality, and Press Quality (See Table 1).

Once the files were generated, the files were then ranked in order of size. Download times were then calculated. The calculations were done with a Web-based calculator called Martindale's File Download Time Calculator (Martindale, 2003). Calculations were done for four common Internet connection types; a 56Kb modem, a wireless 144Kb, a 640Kb DSL connection, and a T1/D1 connection. The original file size is also included for comparison. Table 2 lists the download times and file sizes for the InDesign files.

The file sizes range from 142 KB for the smallest file size type, to 17,466 KB for Press export file type with the original file size of 18,148Kb for the Windows-based output. There are fewer entries for the Mac–based platforms as fewer options were readily available. Figure 1

PDF Settings	InDesign PC	56K modem	Wireless 144K	640K, DSL	T1/DS1
Smallest File Size	142	19	7	0	0
Screen Exp	253	35	14	3	1
Standard	341	47	18	4	1
eBook Exp	587	81	32	7	3
Print Exp	5,008	695	277	62	25
PDFX1a	5,864	818	325	73	30
PDFX3	5,868	818	325	73	30
Press Exp	17,466	2,436	970	218	90
Original	18,148	2,531	1,008	226	94

Data from Martindale's File Download Time Calculator (Martindale, 2003).

Table 2. InDesign File Sizes and Download Times (in seconds).

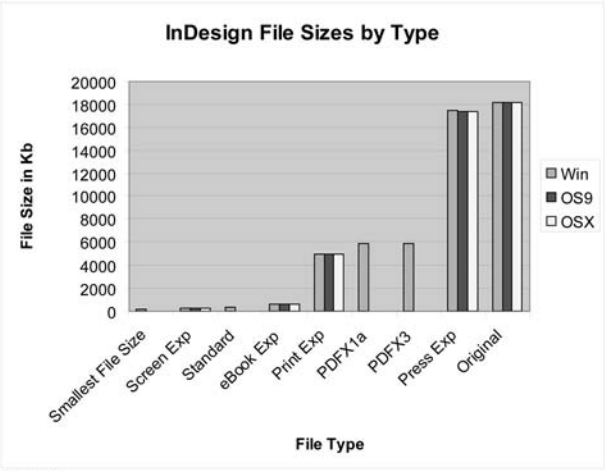

Figure 1

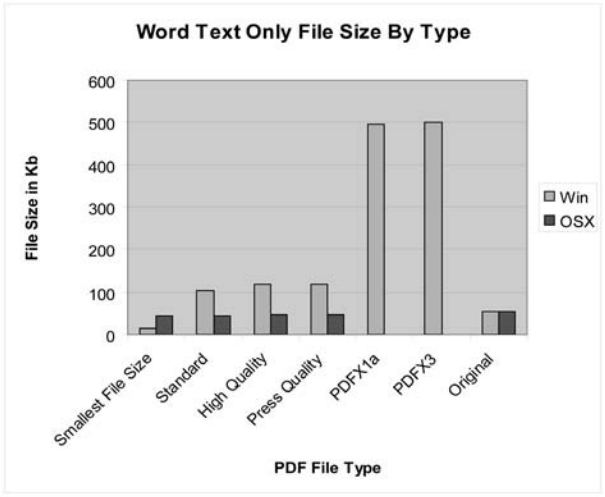

Figure 2

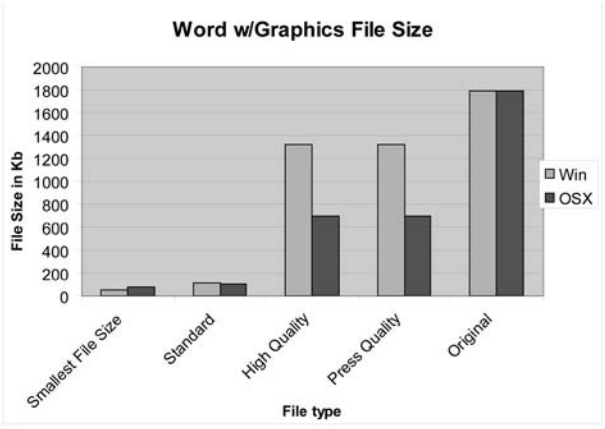

Figure 3

displays a graph of the file sizes obtained for the InDesign files sizes, Figure 2, the Word-text only sizes, and Figure 3, the Word-with graphics files.

The download time ranking for each PDF file types was consistent with the file size rankings. Those PDF file types that were developed specifically for print media (Press, Print, PDF/X-1a, and PDF/X3) display significantly

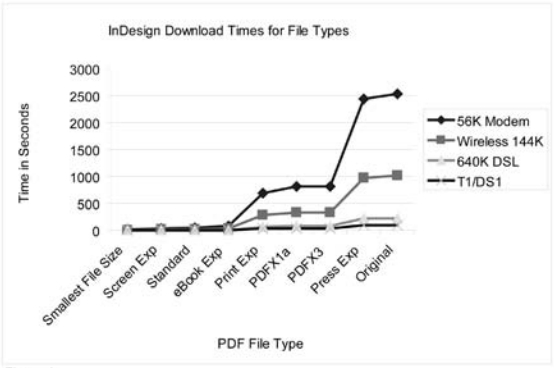

Figure 4

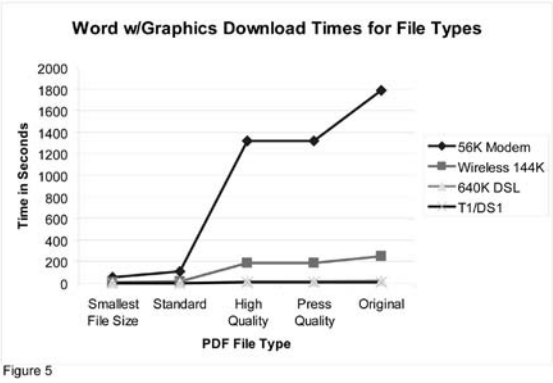

Figure 5

higher download times, especially for the slower Internet connection modes. These can be seen in Figures 4 and 5, where download times are graphed by PDF file type. Comparing the graphs, we see that the relationship between PDF file type, files size, and download speed are consistent across platforms, between programs used to generate PDF files, and the PDF file types.

The final portion of the study experiment was to evaluate the output quality of the PDF files generated. Several of the PDF files generated from the InDesign conversions were enlarged on a 19" monitor to 800% and screen captured were made to compare the quality of the image. These screen captures indicate that the quality of image increases from the Screen to Smallest to eBook to Print to Press, with the highest quality. (See Figures 6, 7, 8, 9 and 10). When printed versions of the same documents were viewed, however, the nature of the individual printer's resolution limits the ability to accurately judge the results without some magnification. It should be noted that printer resolution does impact on the quality of the PDF document reproduction, the users printing capabilities.

Recommendations for the Use of PDF Files Online

There are typically three ways of getting PDF files: distilling PostScript files; exporting from a software program; or using a screen writer (such as PDF Writer).

Figure 6. Screen export

Figure 7. Smallest

Figure 8. eBook export

Figure 9. Print format

Figure 10. Press Export

As a desktop application, it is easy to use and has a strict structure that is highly editable. The choice of method will depend on the software program you use, the final format needed, and the end use.

Nielson (2003) provides five guidelines for PDF usage. These guidelines are: 1) create a Web-based gateway for the PDF documents; 2) make it clear the PDF is only to be used for printing; 3) never allow the PDF to be indexed by a search engine; 4) use the next most recent version of the PDF format (stay one version behind for compatibility limit use of PDF's to documents to be downloaded; and 5) make sure PDF documents are formatted for different sizes of paper, 8-1/2" x 11" and A4, etc. For online use, additional formats and landscape page-orientation should be considered.

Additional recommendations are to review Web and online best practices. Re-design those critical documents that would allow the user to continue using online documents as they typically do. Determine whether you need to open the PDF document within the Web page or in its own window (Krim, 2003).

As for the lack of navigation controls, they are available in Acrobat version 6.0 located in the status bar of various browsers. These controls are standard for Acrobat regardless of the browser. These controls include first page, previous page, next page, last page, and indicate the current page of the total pages in the document. (Adobe Systems, Inc., 2003). An excellent example of a well-designed PDF document designed for the Web and containing navigation controls done by Converse (1994) can be found at http://www.pdfzone.com/download/pdfgde.pdf

Conclusions

File sizes for PDF document file types are consistent across computer platforms and original file types, InDesign, Word-text only, or Word-w/graphics. File size does have an impact on the quality of image obtained and the download speeds of documents. This should prompt one to determine the quality image required and the intended purpose for the document. Printed output quality is very dependent upon the printer resolution as well as the PDF document type.

Bad design is bad design. If you are going to use PDF documents on the Web, you should design them for their completed purpose, viewing, printing, navigating, etc. The strength of PDF lies in the ability to reproduce text and graphics consistently–no substitutions, across platforms, programs, and the Web–Warnock's "universal documents." It is incumbent upon the user to maximize both content and PDF file type in order to produce the best product. Learn to use the tools you are working with to generate better, more productive, usable, and user-friendly PDF documents.

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Trends in Photography: Grain Versus Pixel

Christopher Lantz, Ph.D.

Introduction

As the prices of digital cameras radically change, film-based cameras have not only survived but many new film types and related photographic equipment have been introduced. Digital cameras with interchangeable lenses and manual exposure controls have fallen slightly below the $1000 price point for the first time with the introduction of the Canon Digital Rebel this November. In 1999 an $8000 camera was available at half the Digital Rebel's 6-megapixel (6 million pixels) resolution and in 1995 a 6 MP camera retailed for $30,000. For comparison, 35mm (ISO 100) slide film has approximately 25 MP, medium format 2 1/4 inch square film has 80 MP and 4x5 inch large format film has 450 MP. Six MP is roughly equivalent to the resolution of a duplicate 35mm slide. So how can film still compete effectively with digital imaging for many applications today? The short answer is that film can presently resolve more detail in an instantaneous exposure and film cameras are inexpensive. Although the gap has closed considerably, it is still not possible to manufacture as many pixels in digital cameras as grains in film. Additional reasons for the survival of film include camera features, better media longevity and better image quality in large sized prints and projected images. A discussion of resolution and light sensitivity is followed by sections on digital camera types, recommendations for selecting a point and shoot digital camera and the impact of digital imaging on photography as a profession.

Resolution

The size and number of pixels in digital images or the grain in film defines resolution. The shape and placement of grains in film are more random than the regular arrangement of square pixels in digital images (Figure 1). Pixels in digital images often appear less noticeable and are more camouflaged than photographic grain (Figure 2). This is especially true in photographs with large areas of even tonality such as the sky in a landscape or the seamless background in a product photo. Because of their discernable grain pattern, such photos can initially appear to be lower in resolution than they actually are. A grainy sky in a landscape photo can distract viewers from initially detecting information such as writing on distant signs or details within clouds. The native file compression format used in digital cameras also has an effect on resolution. Most point and shoot digital cameras use extensive spatial compression such as in the JPEG file format. A high degree of JPEG compression will dump detail from even tonalities in skies or seemingly blank areas and retain detail in areas that contain a higher concentration of more tightly spaced detail. In higher-end cameras with more built in memory a RAW file format is available which will record all the information collected from the pixels or photosites in a digital sensor.

Figure 1. 5x5 pixel image of a tonal transition from gray to black.

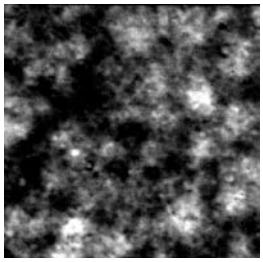

Figure 2. 2000x magnification of a 35mm Ektachrome slide photographed through a microscope.

Successive generations of imaging chips use more densely packed light sensitive photosites. Other approaches to increased resolution are to scan the image, use multiple layers in the chip or use a larger chip size. In a scanning linear sensor the photosites are arranged in a line that scans the surface area of the image projected by the lens in the camera. This approach is identical to the movement of a scanning wand in a flatbed scanner. The scanning approach has the fundamental disadvantage of requiring a stationary subject with the camera locked down on a tripod. Instantaneous capture is not possible with a scanning sensor. In a multi-layer chip, red, green and blue image information is captured simultaneously and in different layers of the chip. This has the advantage of using 1/3 the space on the chip to capture color information and is similar to how color is captured with the multi-layers in color film. The majority of digital cameras still use conventional Charged Coupled Device (CCD) or Complementary Metal-Oxide Semiconductor (CMOS) chips that capture red, green and blue information in one layer. Increasing the size of the chip seems to be the most logical and easy way to increase resolution but the probability of defects increase and costs rise, as chip sizes get larger.

Light Sensitivity

Other than resolution, another important point of comparison between film and digital is light sensitivity

or performance in low light. Images captured in low light sacrifice resolution. As the light level in a scene decreases so will the resolution capability of the digital camera. Indoors or at night there is often not enough light to activate all the photosites in a specific area of the imaging sensor. In order to intensify the image in low light, additional photosites in proximity to those activated by light will be artificially turned on or interpolated. Noise or empty resolution is the result because photosites were activated artificially and not in reaction to light or detail from the lens. Light sensitivity is adjusted in film cameras by choosing to use different types of film. Films have different speeds or sensitivities to light. The small grains in slow speed film (ISO 25-100) give it high resolution but less sensitivity to light. Small light sensitive gains with less surface area collect less light. The larger light sensitive grains in high-speed films (ISO 400-3200) give it less resolution but more sensitivity to light. Large gains with more surface area collect more light. Digital sensors are able to produce images in lower light levels than high-speed films but such highly interpolated digital images are often not useful as evidence or scientific data.

Digital Camera Types

Digital cameras are available in seven main product categories ranging from toy or web cameras to camera backs for professional film cameras. A listing of each category is followed by summary sections and then a more detailed analysis of the point and shoot category is provided for those in the market to purchase a digital camera.

1. The least expensive "toy" or "web" cameras range from 640x480 pixels-2 MP and cost $75-175.
2. Fixed lens point and shoot cameras range from 2-6 MP and cost from $175-1000.
3. The interchangeable lens student SLR (Digital Rebel) is 6 MP and costs $1000 with lens.
4. Prosumer interchangeable lens SLR's are 6 MP and cost from $1300-1700 with no lens.
5. Professional interchangeable lens SLR's range from 4-14 MP and cost $3000-5000 without lens.
6. Instantaneous exposure digital camera backs range in resolution from 6-22 MP and cost $9000-29,900 without camera or lens. These backs fit medium format film cameras.
7. Scanning backs for 4x5 cameras range from 56-422 MP and cost $6500-24,995 without camera or lens. This back can only photograph stationary objects with the camera on a tripod.

Fixed Lens Point and Shoot Digital Cameras

Fixed lens point and shoot digital cameras are so numerous that specific models will not be addressed in this paper. I counted 63 models from 16 manufacturers as of November 2003. The mid-price models range from 4-5 MP and some have very small form factors with low quality optics. The high end point and shoot models often have manual exposure controls, resolutions from 5-6 MP and prices very close to prosumer models.

Low Cost Digital SLR

The low cost interchangeable lens SLR (Single Lens Reflex) digital camera with manual exposure controls is the newest product category started by the Canon Digital Rebel. The Rebel is essentially a lower price ($999 with lens) manual SLR camera designed to fill the same "student camera" product category as the film based Canon Rebel models. Traditionally, student cameras have been the lowest cost film cameras with manual controls and interchangeable lenses. The Digital Rebel has a little lower build quality and has the same a 6 MP resolution as the more expensive prosumer SLR cameras. This camera will be obtainable for many more students when it reaches the same price as the current $200 film based student cameras.

Prosumer SLR's

Prosumer digital cameras in the $1300-3000-price range also have interchangeable lenses and manual controls in addition to some professional features such as a PC flash synch plug for studio flash equipment and higher build quality than the Rebel. Some examples of prosumer cameras include the Nikon D100, which has a 6 MP resolution at a cost of $1400, and the Canon EOS D10D, which has 6.3 MP at a cost of $1300. These cameras do not include a lens or accessories such as memory cards.

Professional SLR's

Professional digital cameras such as the Canon EOS–1D with 4.15 MP or the Nikon D1X with 5.47 MP ($3000-4000) are cameras of more rugged construction than the Rebel and prosumer models. These models have rapid sequential fire capability but not necessarily more resolution than the prosumer models. Rapid-fire capability is more important than resolution for newspaper and sports photographers. There are also professional cameras with higher resolution than the prosumer models including the Canon EOS 1DS with 11.1 MP and Kodak 14N with 14 MP. These cameras are approximately half the resolution of 35mm film and at a cost of $5000 each without a lens.

Instantaneous Exposure Digital Back

The instantaneous film backs are designed for medium format film cameras and range in price from $9000 for a 6 MP model to $29,900 for a 22 MP camera back. The

top of the line models such as the $29,900 Phase One H 25 and the $27,500 Leaf Valeo 22, use the same 22 MP chip. These cameras represent the current price point of an imaging system that is close to matching the resolution of 35mm ISO 100 slide film and is able to take an instantaneous exposure.

Digital Scanning Back for 4x5 Inch Camera

The last product category is the digital scanning back for 4x5 inch large format film cameras (figure 3). These are essentially high-resolution film scanners adapted to scan the image projected by a lens. Scanning backs are capable of the highest resolutions because they soak up additional pixels by slowly scanning the image with a linear sensor. This makes them very specialized products useful for studio still life product photography. My school has recently purchased the least expensive Betterlight 4000E model ($6500). The 4000E is capable of capturing 56 MP or 3750x5000 pixels (Figure 4). I use it to teach view camera movements and studio still life photography. The top of the line $25,0000 Betterlight back can capture up to 422 MP or 10200x13800 pixels. This is close to matching the resolution of 4x5 film. It is still not close to the resolution of 8x10 film that is used in some types of advertising photography. Keep in mind that these are scanning systems that can only photograph stationary objects indoors, under thousands of watts of bright continuous light, with the camera locked down firmly on a tripod.

Figure 3. The Betterlight system includes a scanning sensor that is inserted into the film back compartment of a 4x5 inch view camera. This sensor (top) is connected with a cord to a control box (bottom left). This control box is connected to a Macintosh or PC computer running the "Viewfinder" scanning software.

The sensor back of the Betterlight looks like a large film holder and is inserted into the back of the camera. This back is attached to a control box by a cable. The control box contains a hard drive and associated electronics that is connected through a SCSI interface cable to a Macintosh or PC computer running the "viewfinder" scanning software (Figure 5). The viewfinder software in conjunction with the control box and camera back works very similar to flatbed scanning software. The image is first pre-scanned within the viewfinder software (45 seconds). Then the pre-scan image is adjusted for brightness and contrast before the longer final scan (up to several minutes). Around 3000 watts of continuous light is needed for the higher resolution scans. It is not possible to use flash with a scanning back. The picture is ruined if the camera is bumped or the subject moves during scanning. Since these backs fit on a standard large format camera all the advantages of camera movements are possible. The lens and film plane are movable on a large format camera (figure 6). Camera movements provide additional subject placement, plane of focus, perspective and shape controls. I still use film in our 4x5 camera when I need to make an instantaneous exposure with a flash or a time exposure longer than is possible with the scanner. 4x5 film is higher in resolution, less expensive and requires less light than the 4000E Betterlight system.

Figure 4. The enlarged image detail (top left) corresponds to the small area marked by the white square in the larger original photo of the two cameras. This is a 150x150 pixel portion of the larger 3700x5000 scan made with the Betterlight 4000E back.

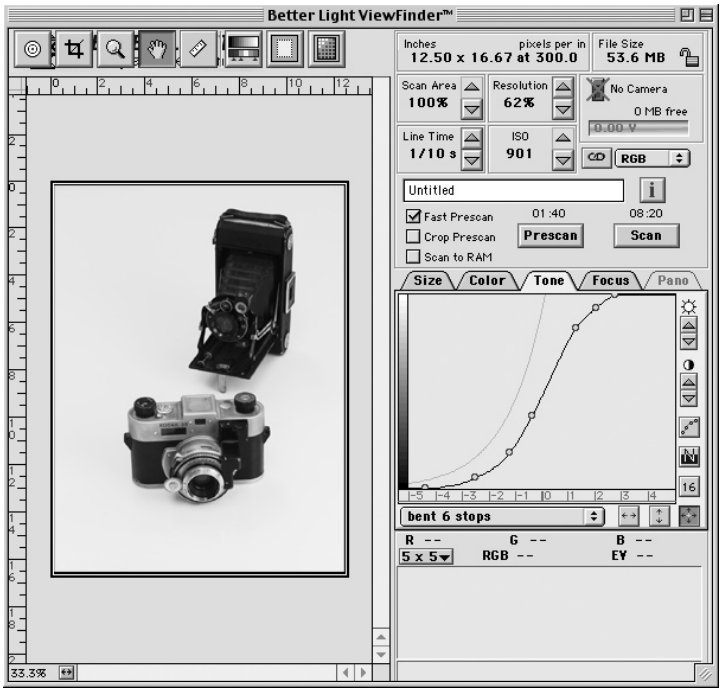

Figure 5. The "prescan" and "scan" features of the Viewfinder software operate in an identical fashion to desktop scanner software.

Figure 6. Side view of a 4x5 inch monorail view camera with the film back to the right and lens board to the left.

Selecting a Point and Shoot Digital Camera

Since many readers may be selecting cameras form this product category I have provided some suggestions to keep in mind when purchasing a digital camera. Fixed lens point and shoot cameras were the only affordable type of digital cameras on the market for many photographers prior to the first quarter of 2003. Since many of the least expensive cameras in this category do not have manual exposure controls they are not considered a viable option for most professionals or advanced amateur photographers. One exception includes the practice of taking a digital preview photo prior to shooting the final picture on a film. This is similar to how Polaroid's are used by professional photographers for client approval of composition.

Low-End Point and Shoot Cameras

The least expensive cameras in the point and shoot category usually use 1-2 MP chips. The limitation of these cameras is often not the sensor. A 1-2 MP sensor is more than adequate resolution for PowerPoint presentations on a data projector or screen sized images for web pages. The problem is with the optics. The lowest cost cameras often compromise on the quality and speed of the lens in order to keep prices low. Such compromises are also made on more expensive cameras with ultra small form factors in order to keep camera sizes small. In some cases uncoated plastic optics are not much better than on a disposable camera. These can also be "slow" lenses that are unable to transmit much light to the imaging chip. The glass or plastic surface of these lenses are sometimes only 3 or 4 millimeters in diameter and can produce flare from uncoated surfaces. Cameras with such slow lenses depend more heavily on built-in flashes that produce harsh unnatural light and often have inadequate light output beyond 20 feet from the subject. Electronic flash lighting is unnatural by virtue of its angle and the high contrast of the shadows it casts when compared to natural light (figure 7). There are some techniques that can be used to soften flash lighting such as bouncing it off a white card (figure 8) but the small built-in flash available on cameras in this product category lack both the power and angle adjustments to make such techniques possible.

The lowest cost digital cameras can also have fixed focus or "focus free" lenses. A focus free lens is essentially always out of focus unless you happen to be lucky enough to have your subject at the exact focus distance (usually 10 feet) set at the factory. Almost all of the better low cost digital cameras and the most inexpensive point-and-shoot film cameras have simple auto focus mechanisms. Simple auto-focus ensures sharp focus with subjects at the center of the viewfinder and at various distances from the camera. Auto-focus systems have a sensor that judges the distance to the subject and then changes the focus of the lens elements to adjust for different distances. Although simple auto focus is much better than fixed focus it still causes problems if the photographer wishes to place the subject of the photograph off-center. One approach to solve this problem is to use multiple focus sensors across the field of view and not just in the center. This improved focus system is available in film cameras under $200 but is not typical for the lower price point digital

Figure 7. This subject was lit with direct flash and has a harsh shadow to the right of the camera.

Figure 8. This is the same subject as figure 7 but a bounce card was used to remove the shadow and soften the light from the flash. Light that originates from a larger area produces more diffuse and pleasing light for many subjects.

cameras. Focus "lock" or manual focus are other ways to manually compensate for subjects off of camera center. Another refinement that the low cost digital cameras often lack is light metering features such as multi-cell metering and backlight control. Multi-cell metering collects light readings from various positions in the viewfinder and averages the readings. This compensates for backlit scenes that would turn out as silhouettes without this feature. A light meter "lock" feature is another way to manually compensate for back lighting.

Used Point and Shoot Cameras

Unless quality requirements are extremely low it pays to steer clear of the lowest cost cameras. Used cameras can be the exception to this rule if they are not more than one or two years old. Such cameras are sometimes available at less than 1/3 of their original price. This equipment is discounted so steeply because it can have the same chip performance as the least expensive point and shoot cameras currently available. Gordon Moore was a past president of Intel who stated that chip performance would be doubled and costs would be reduced by half every 12-18 months (Jackson, 1997). Used top of the line point and shoot cameras often have very good quality optics. Fewer compromises on optical quality seem to be made with top of the line models because of their high original purchase price. Moore's law does not apply to progress made in optical design.

Mid Range Point and Shoot Cameras

Point and shoot cameras in the $300-1000 price range have a 4-6 MP sensor and can have better quality lenses with true auto focus and enough speed to take pictures of brightly lit interior scenes without a flash. Some of the more expensive models have manual exposure controls. Selecting a camera with the highest resolution is less important than the quality of the lens and manual controls. This is especially true if the highest resolutions are not needed in the first place. Buyers should always be suspicious of cameras in any product category that have better than expected resolution at a lower than expected price. Optical quality and camera features are sacrificed to keep prices low and sensor resolution high. It is easy to cancel out the advantages of a high-resolution chip by mating it with a lens, exposure and focusing system of inferior quality. What good is a high-resolution image if it is inadequately lit or soft in focus? Photoshop does more harm than good in drastic image correction situations. Sometimes it is better to start over by capturing a better quality image in the first place. Some indicate that they want to record images at a higher resolution than they will initially need. Archiving images for some undetermined future use is best done on film. How many times have you lost an image due to media errors such as scratches on a CD-ROM or surface errors on a hard drive? A stack

of photos in a drawer or in a fireproof document box provides very reliable storage. Black and white photos have exceptional archival characteristics because their grains are simply silver metal. Photographic prints from color negatives have comparable longevity to archival inkjet inks. Print from slide processes such as Ilford Ilfochrome use more stable pigments than archival inkjet inks or photographic prints from color negatives.

Future Trends in Consumer Digital Cameras

Digital cameras are often replaced every year or two in order to take advantage of higher resolution chips. This situation could lead to an upgrade market, very similar to the computer upgrade market. Consumers may be able to send their cameras in for an imaging chip upgrade or a do it yourself chip upgrade kit may become available. Another option is that imaging chips could be designed to conform to the form factor of 35mm film cassettes, thus allowing film cameras to be converted for use as digital cameras. This approach has been tried unsuccessfully in years past (Silicon Film) because the electronics would not fit effectively within the camera without modification such as a housing for additional electronics in an external case. Another possible trend is that interchangeable lenses dedicated to small chip cameras will become more popular. The $1600, 5 MP Olympus E-1 is the first camera to use such a standard (4/3 lens mount).

Impact on Profession

Photography is following a similar pattern to many professions touched by disruptive technology. A disruptive technology completely changes the procedures, workflow and even the lifestyle of employees and clients. There are some photographers who are early adopters and embrace change, sometimes before such change is practical. Aggressive marketing can encourage early adoption before rational comparisons with existing mature technologies can sometimes be made. At the other end of the spectrum from early adopters are the resisters to change. There are photographers who wait too long to adopt digital photography even for assignments where it surpasses the capability and economy of film. Such photographers often loose bids for work because their material costs for high volume jobs are well above the competition and turn around times are longer for time sensitive jobs.

A look at the use of photographic imaging in industrial and manufacturing processes could be a revealing predictor of the changes that could happen on a larger scale in the next few years. Computer based imaging has become more efficient than film 20 years ago for applications such as microfiche and the production of solder masks for circuit boards and early integrated circuits. Scanning technology has all but displaced the process camera in prepress operations in the graphic arts. Digital printing technologies have made their way into minilabs and large photofinishers but traditional photosensitive papers are still dominating. Medical imaging is another example where digital did not totally obsolete film. CAT scans or NMRI images are often imaged back onto film because it is an efficient storage medium for high-resolution images and it is easily displayed on light boxes. The pattern seems to be that technology diffuses into different tasks and job categories until a crossover point is reached. The crossover point is reached when Moore's law brings prices low enough to cause disruptive change. Many would say that we have past this crossover point two or three years ago with photography. In many product categories this is true. Some commercial photography has not reached the crossover point yet because of the cost of high-resolution digital cameras and camera backs such as the Betterlight system.

Conclusions

Many photographers have very strong opinions on the digital versus film debate. Clients are often given contradictory advice on going digital or analog for the same jobs. There are valid benefits to businesses that do not have to worry about chemical wastes and can reclaim some space by removing darkrooms and replacing them with more space efficient digital printing technologies. On the other hand, there have been cases of undergraduate programs that have reestablished chemical darkrooms after their elimination due to the untested underlying assumption that the more current technology is always the better technology. Traditional darkroom equipment requires much less maintenance and depreciates much more slowly than computers and printers. My school uses enlargers that are well over 30 years old with minor costs for maintenance every decade or so. For comparison, we have 5-year-old computer workstations that originally cost in excess of $10,000 each that are now worth about $300.

Some photographers will make the argument that there is no substitute for the craft of manipulating the densities of a photo by making shapes with your hands in the path of the projected image in the darkroom, or the satisfaction of seeing this image come up in the developer. Many clients have predicted that digital photography will transform professional photographers into lower skilled workers. Photographers will be able to submit flawed or inferior images because corrections are much easier to accomplish with Photoshop. Teaching digital photography does not represent a lowering of the craft of photography, unless crucial technical topics are removed from the curriculum. These topics include depth of field control with f-stops and motion control with shutter speeds. Optical principles such as large format camera movements

and the wide range of perspective controls possible with different interchangeable lenses are also important. Such principles are just as important with digital as they are with film. Wait until the price point of digital cameras with appropriate features become affordable. Moore's law will see to it that prices will drop rapidly. Don't make an investment in digital capture to the exclusion of film if it means compromising on point and shoot cameras of inferior optical quality and auto-only exposure. In this case photo educators should not go all digital. Keep the film camera and scan photos until $200 student digital cameras are available with the appropriate features.

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Adobe's Portable Document Format as a Standard for Cross-Media/Cross-Platform Display and Output

Milos Krsmanovic, M.Ed.

Introduction

Digital imaging professionals have been constantly looking for a file format that will provide for high quality and uniform document display and output across diverse computer operating systems and output devices. In the late 1990s, PDF file format emerged as a universal format for cross-platform, cross-media, and cross-application use because of its innovative and advanced coding structure that provided enhancements over other file formats that were previously used to present documents in a variety of displays and outputs. Today, PDF is commonly used not only for professional and desktop printing, but also for multimedia presentations, Internet publications, as well as for document archiving. The Usage of PDFs has expanded beyond printing and publishing industries: governments and libraries have been accepting PDF as an optimal file format for saving, archiving, and indexing information. The purpose of this paper is to inform the audience of graphic communication educators and students of those more and less known characteristics of PDF file formats that make this format the standard for cross-media and cross-platform document display and output.

PDF and Other File Formats

When comparing PDFs to other file formats, PDFs provide numerous enhancements in each of the purposes they are used for. For the purpose of printing and publishing, Encapsulated PostScript™ (EPS), Tagged Image File Format/ Imaging Technology™ (TIFF/IT), PostScript™ (PS), Desktop Color Separation™ (DCS), or any native application file format (such as QuarkXpress™, Adobe PageMaker™, Adobe FrameMaker™, Adobe InDesign™, etc.) were mostly used prior or during the evolution of PDF. The advantages introduced with PDF were that PDF provides fewer variables to worry about when preparing, checking, troubleshooting, rasterizing (RIPing), and outputting (displaying) a document. This is because PDF files can have all the design elements (texts, fonts, images, output specifications) embedded within a single file; that means all the essential information for processing a document is found in one location – in a PDF file itself. Unlike other "self-sufficient" file formats (like PostScript, for example), PDFs show the most predictable and uniform performances when electronically transmitted and outputted to a variety of output (display) devices.

PDF and PostScript file formats, unlike native application formats, can embed all the text, images, graphics and fonts. This guarantees no missing file components and ensures proper display and reproduction of design details on any computer station and in any stage of production. Unlike EPS and PostScript file formats, PDFs can be viewed, edited, and compressed. Viewability is important for quick file checking as it enables PDF documents to be easily edited. PDF's editability is important for any last minute changes within a file document at any stage of production. Compressibility of PDFs is beneficial for transferring files across networks or when storing or archiving files on organizational network's servers. PDFs have advantage over TIFF/IT formats because PDFs support not only raster data like TIFF/IT, but also vector data, which results in better text reproduction and generally smaller file sizes of PDFs. On the Internet, PDF is currently not as widely accepted as HTML but is getting more and more followers due to PDFs advancements in supporting high compression algorithms to provide smaller file sizes of documents for quicker and more of a seamless display within users' Internet browsers.

PDF's Universality

The major strength of PDF is that it is universal: PDF is not used for just one purpose (print or Internet, for example) but for many purposes. A single PDF file needs no special customization for a specific output (display) media: the same PDF file can be used across diverse media (print – Internet – document archiving, for example) and its coding structure needs little or no modification to accommodate for predictable and uniform display across diverse software and hardware environments.

PDF file format can be classified, using Efford's (2000) terminology, as an "interchange format" because it is usable with the widest possible range of hardware and software unlike "device and software specialized" file formats that are used only with specific hardware or software (pp. 63-64). Romano (1999) introduced the term "consolidated files" (p. 2) that are files used to bring all of the component files, both raster and vector, into a single format (a container) that is accepted by an output

processing system (a RIP). PostScript, as an earlier version of a consolidated format, allowed editing of created consolidated file only upon re-creation from the original component files. Romano claimed that PostScript has never really lent itself to interactive editing, although there were some attempts from the third-party developers (p. 3). Creo Scitex™ came with PostScript editor application called Scitex Remake; yet this product could not enable significant altering of PostScript documents that would make this file format competitive to PDF in the domain of editability. Romano also wrote that prior to PDF, CT (Continuous Tone™), LW (Linework™), or TIFF/IT file formats were used because of the requirements of specific output devices and due to limitations of their rasterizing systems (RIPs). The problem with those raster-only file formats was that they were uneditable and voluminous which negatively affected the speed of production, especially in high-volume networked facilities.

Cardin, Castellanos, and Romano (2001) broke down the advantages of PDF files into five main capabilities of PDFs:

- To preserve design richness
- To create predictability
- To maintain some editability
- To create searchability
- To allow repurposeability [using same files for diverse media, such as printing or Internet]
- To allow high-end printing

Design richness of PDFs means that there is no loss of quality of text and images from the stage when they were created by their native applications. Vector object data, for example, is saved entirely within a PDF document which allows the vector graphics to be displayed at any zoom level, maintaining high quality (Alspach, 2001, p. 5). When Microsoft™ introduced Rich Text Format™ (RTF) for cross-platform use, it was not found to be robust (rich) enough to become a portable document format (Romano, 1999, p. 38) and a serious competitor to Adobe's PDF. Having its text in ASCII™ format enables search for words and phrases within PDFs (Cardin et. al. 2001, p.34). Due to their 7-bit ASCII nature, PDFs have advanced coding structure that makes them repurposeable as they can be accommodated for display or output across diverse software, hardware and operating system environments (Romano, 1999, p. 38).

Probably the most widely recognized value of PDF file format is that it is emerging as a standard for professional printing. When Adobe Corporation created Portable Document Format in 1993, PDF was expected to provide better printing performances than its predecessor, the PostScript file which was conceived in the early 1980s by John Warnock, one of the founders of Adobe Systems. PostScript was created as a device and platform independent programming language that graphically describes the text, shapes, and images that appear on a page. PDF operators are mostly one letter, unlike the verbose PostScript operators. Several PDF operators combine more than one PostScript operation. Since the PDF interpreter runs straight through the code when it displays or prints, PDF files allow faster printing: in average, they print three to four times faster than PostScript (Romano, 1999, p. 33). When comparing PDF to PostScript file format, Beals (2000) quoted Mr. Campbell from Revere Graphics™, a prepress house in Portland, Oregon that runs a 100-percent PDF production workflow: "PostScript is like a giant novel. You have to get to know all the characters. Something that happens in the first chapter can be critical to what's happening at the end of the book. PDF files are more like a group of short stories. You can open them up anywhere and find out instantly what's going on" (p. 1).

One of the strengths of PDF file format is its cross-media repurposeability. PDF file repurposing is enabled through creating PDFs as unstructured, structured, and tagged. While unstructured PDF files are files created for no specific purpose, structured PDF files enable users to convert or repurpose a PDF file for another format (such as Rich Text Format, PostScript, or EPS, for example), while retaining much of the original page layout structure. Tagged PDF files can retain original formatting when converting to other formats but are also able to reflow text, which is not the case with unstructured or structured PDF files. For the purpose of creating eBooks, for example, users should always use tagged PDF files because they offer the most flexibility when it comes to viewing the final product on the greatest number of viewing devices (Harvey, 2002, p. 301). Text reflow capabilities of tagged PDF files enable optimal display of PDF files even on handheld devices.

Growing Popularity of PDF File Format

Romano (2003) estimated that PDFs represent at least 153 billion pages that move over the Internet annually. "By 2020, it could be a trillion pages" predicted Romano (p. 1). Trend Watch for Graphic Arts (TWGA) Web site provided survey reports that showed growing interest for using PDFs as final color proofs. TWGA research showed 51% increase in soft [monitor only] proofing among graphic designers ("Publishers begin…" 2003, p. 49). Graphic Arts Technology Foundation (GATF) conducted a survey in 2001/2002 which showed that prepress and printing firms received QuarkXpress files from 53% of their customers, PDF files from 23%, and the remaining percentages in PostScript/EPS or native application formats (Miley,

"PDF for Print" 2003, p. 1). According to the survey respondents, the top five benefits of working with PDF files were the following:

1. Fewer cross-platform issues
2. Smaller files
3. Faster system throughput
4. Ability to soft-proof PDF files
5. Easier preflight

Related to popularity of PDF file formats, are the findings from TWGA reports (2003) that showed high percentage (40%) of research survey respondents to consider "cross-media communications campaigns" as the top sales opportunity for publishing firms ("Cross Media is…" p. 1)

PDF is still an open and evolving standard. According to Lewiecki and Davis (1999): "New features and auxiliary standards make PDF the first file format with the potential to combine the four key properties of networked information: document, database, transaction, and program" (p. 1). Having this in mind, one of the possible dominant trends may be in combining features of PDF file formats with XML language for extracting texts out of PDF documents for later cross-media file repurposing or for document cataloging in libraries. Extracting text out of many file formats (Microsoft Word, QuarkXPress, HTML, etc.) has been problematic and tedious task. Nevill-Manning, Reed, and Witten (1998), for example, wrote in depth about difficult, almost to impossible, efforts to extract text from PostScript files (p. 482). No page definition format has been able to support fast and easy extracting texts from itself, like PDF is capable.

For all these reasons, PDF is emerging as a standard file format for file storage and archiving in libraries, completely replacing microfilming and other outdated techniques that relied on expensive and robust techniques for information capture and storage. Looney (2003) also predicted that Adobe's PDF/A, a subset of PDF, will address the need to "electronically archive documents to ensure preservation of their contents over an extended period of time" (p. 1). Arms (2000) supported this prediction by claiming that PDF format is proprietary and thus may be more stable in the long run than other standards that are not backed by a corporation known for its good products and a wide user base. "The definition of PDF is widely published, and the broad use of this format in commercial applications guarantees that programs will be available for it even if Adobe should go out of business or cease to support it" (pp. 183-185).

Conclusion

With the current level of acceptance of PDF file format and its continuously upgraded cross-media usability, PDFs have established themselves as one of the leading digital file formats of today. It can be expected that PDF's integration with XML will enhance PDF's capabilities to fully offer its textual context to the search engines of digital libraries and of the World Wide Web. This enriching of PDF's structure should enable PDFs to be fully integrated within network browsers and have the same seamless downloading ability, text reflow ability, and text search ability as HTML files. By gaining enhancements in Web performance and further developing their print uniformity and predictability, PDFs can foresee a bright future for themselves. Due to PDF's outstanding cross-media and cross-platform output uniformity and predictability, it is hard to envision a digital file format that could outmatch PDF file format, at least not in the near future.

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Using Images Effectively in Page Design

Judith A. Birchman, M.A.

Introduction

Images are an integral part of most page layouts. Documents such as brochures, newsletters or information flyers require images to support and enhance the text. Design elements such as rules, borders and boxes are regularly used to format pages, images too can be manipulated to suit a particular design purpose. For example, images can be used as backgrounds to anchor elements, frames to delineate regions or shapes to help balance the page. Images can also be used to add interest to a page by adding shape, texture or color. To use images in a creative manner, it is necessary to realize that the image is not a static entity. Modifying images for a particular design purpose usually results in a more creative design.

Most design layouts include some type of image. Images are often as important to the design as the words on the page because they support the purpose of the document in some way (Oldach, 1995). There are many types of images — photographs, illustrations, diagrams and logos to mention a few. Images are often used in a layout to add interest to the document or to break up the monotony of the page. With volumes of clip art available, even novice designers find it is easy to add images to their documents. However, most design novices use images in a predictable way, which is in their original format.

The Purpose of an Image

Peterson states — "Much of design is nothing more than the organization of elements to support a concept." (Peterson, 1996) All the elements of a design serve a purpose. In order to use images effectively in a design, it is important to understand what purpose the image serves in the layout. Oldach states that images can serve a variety of purposes such as organizing content, interpreting the message or controlling interest (Oldach, 1995). Whatever the reason for using an image, the goal is to use it creatively and effectively.

There are two primary reasons for using images in a layout. First, an image may be part of the content of the piece. For example, a photograph might be used to show the product being advertised or a diagram used to illustrate a process that is being described. In many cases, the required copy and images fill the page and it's just a matter of arranging the elements in a pleasing, organized layout.

Second, an image may be used as a design element. Images can be used to add structure or interest to the page. In these cases, images are being used as design elements. For example, an image can be used as a background to visually anchor the copy to the page and better integrate the page elements. Another example would be to use an image to balance the positive/negative areas of the page by adding shape or value to the layout. This usually results in a more pleasing and creative arrangement.

Images as Design Elements

When designing a layout, there are times when the content is predominantly text. In some cases, the text might not be enough to fill the intended page. It is situations like these that require the designer to come up with a creative use of images to complete the page layout. To better understand the concept of images as design elements, the following examples will show how a single piece of clipart can be used in a variety of ways.

Structural Uses

Designers use graphic design devices such as rules, borders and boxes to organize information on a page (Rabb, 1993). The purpose for using these devices can be considered structural in that they help to organize the elements on a page. For example, rules can be used to separate information for clarity or borders can be used to group items to show relatedness. Images can be used in the same way.

Aesthetic Uses

Images can also contribute to the aesthetics of the design by adding texture, shape, contrast or color. Repeating an image to add pattern to the page can create visual texture (Siebert & Ballard, 1992). A crosshatched effect on an illustration can also add texture to the design. Shape can be described as an element that creates a form on the page (Peterson, 1996). For example, the silhouette of an image can add a distinctive shape to the page such as a curve to soften the visual effect. Contrast may be added by screening images so they have different values of gray. In most cases, it is difficult to separate structural uses from aesthetic ones. All the elements on a page contribute in a variety of ways to the overall design. The following examples will demonstrate this.

Examples

One structural use for an image is to use it as a background to set off content. Backgrounds can serve several purposes —they fill empty space, balance the page and set up a framework for other elements on the page (Kristof & Satran, 1995). Figure 1 shows an example that uses a clipart image as a background. Since the

copy is minimal, the image contributes to the layout in several ways. It is used as a container for the copy and to integrate the heading with the other page elements. The image also fills space on the page that creates a better balance of positive/negative space. Additionally, it anchors elements to the page by integrating them with the background.

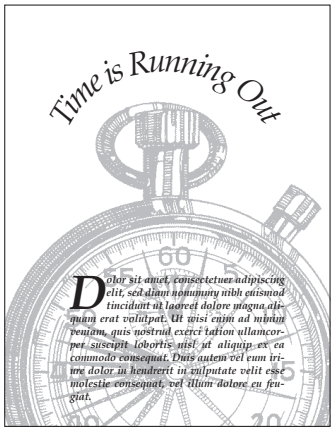

Figure 1. Image used as a background.

Another structural example uses several images to frame elements on the page. Frames can call attention to content as well as add interest to the page by adding shape to the design. Figure 2 shows how the images can frame the copy. By breaking the image into several pieces and spreading it out on the page, a more interesting negative shape is created to highlight the copy. The images also add interesting shapes to the design and type.

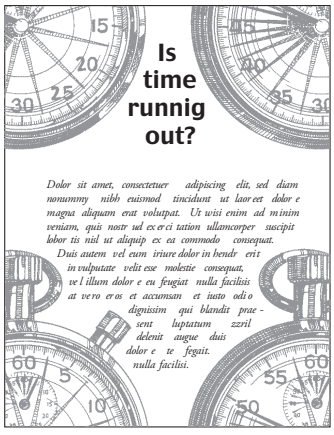

Figure 2. Images used as a frame.

Images can also be used as structural panels that delineate zones on the page. Certain areas of the page can be designated for particular uses such as headings, body copy and information. Figure 3 shows an example in which the image is repeated to serve as panels that hold the heading and pertinent information. The shapes created by the images highlight this key information. At the same time, they isolate the body copy to set it off from other elements.

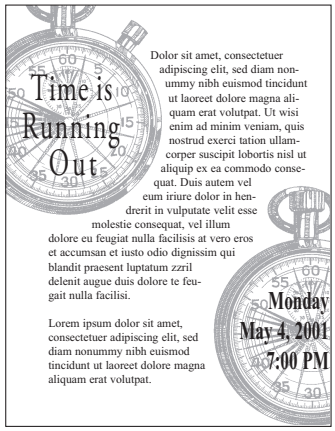

Figure 3. Images used as panels to hold content.

Finally, images can be used to tie elements together. Figure 4 shows how the image can be integrated with the text. By wrapping the copy along the edges of the image, the separate elements are unified and solidly anchored to the edge of the page.

Figure 4. Image used to integrate page elements.

The previous examples have also demonstrated that a single image can be used in many different ways by manipulating the image. The image does not have to be used in its original size or even in its entirety. The image can be adjusted to suit a particular purpose. Also, by not

using the image at the original size and orientation it adds an element of interest. "When something is unanticipated, it is more likely to be attractive..." (Landa, 1998).

Manipulating Images

There are a variety of ways to change the appearance of an image. Consider four major types of changes. 1. Adjust the size. 2. Change the orientation. 3. Change the position on the page. 4. Change the attributes of the image.

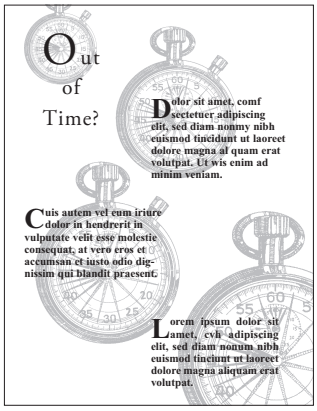

Figure 5. Image repeated at different sizes.

Image Size

First, there are several ways to use the image at different sizes. One way is to enlarge the image. Figure 4 shows that by enlarging the image and cropping it, it appears anchored to the edge of the page and provides an interesting shape to work with. Also, when an image is cropped, it creates a sense of closeness or intimacy (Landa, 1998).

The example shown in Figure 5 repeats the image at different sizes. By repeating the image, it guides the viewer through the information by leading the eye down the page and through the information in stages. By sizing the image in a sequence—small to large—, it also adds a feeling of depth to the layout.

Image Orientation

Second, you can change the orientation of the image. If the image does not work with your intended layout, try rotating it or angling it on the page. Figure 6 shows an example of a tilted axis. In addition to changing the angle of the image, the text is repositioned at the same angle.

Figure 6. Image in new orientation

Changing the position and orientation of the image can also create a feeling of motion as shown in Figure 7. It also creates an informal or fun effect. Notice the curves along the left side of the text created by the interaction between the text and the image. These curves catch the viewer's eye and lead it down the page.

Image Position

The third category deals with the position of the image on the page. By positioning the image at different locations on the page an entirely new layout is created. When the image is centered as in Figure 8, it separates the columns of text and becomes a focal point. If it were moved to the right or left of the columns, it would take a more subordinate role such as a border. To create a more unique effect, use just a part of the image by cropping it or positioning it so that it bleeds off the page as shown in several of the examples.

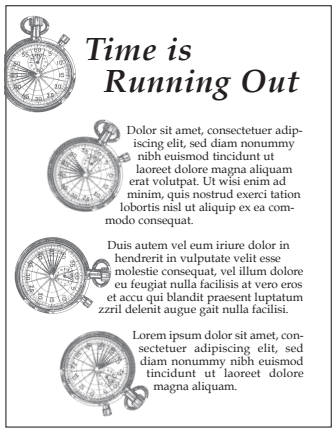

Figure 7. Image rotated to add motion.

Image Attributes

Finally, consider changing the attributes of the image such as its color, value, shape or style. For example, you can soften the image by screening it as shown in several examples. Screening an image changes it from a solid (100% saturation) to a tint by diminishing the percentage of the pure color.

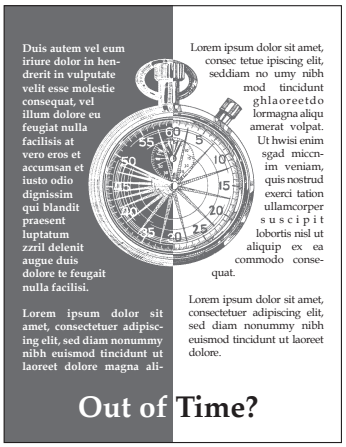

Figure 8. Positive/negative areas of image reversed.

Another attribute change is to reverse the positive/negative areas. This adds contrast to the page as well as the unexpected.

Additional changes to the attributes of the image can be done with an image-editing package like Phtoshop. The image style can be changed from a line drawing, for example, to a watercolor or charcoal pencil by applying a standard filter to the image. An example is shown in

Figure 9. Charcoal pencil filter applied to image.

Figure 10. Drop shadow added to image.

Another change that can easily be done in Photoshop is the drop shadow effect shown in Figure 10.

Software for Image Modification

Making modifications to stock images is best done using software packages designed for page layout. PageMaker, FrameMaker, InDesign and QuarkXPress facilitate most of the changes covered in the examples. Screening, sizing, rotating and cropping images are some of the modifications that can be accomplished with these packages.

More advanced effects such as drop shadows and filters would require an application such as Photoshop that is primarily for creating and editing raster images. The ease with which these changes can be made makes it a worthwhile investment. All of these software packages provide options for creatively modifying and integrating page elements.

Summary

Creative use of images requires a certain amount of experimentation. As the examples have illustrated, it just takes one good image to create a variety of layouts. First, determine the purpose of the image. Second modify the image to suit the needs of the design. Third, experiment with ways to modify the image. Following this process will result in creative designs that use images in unexpected ways.

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Faculty Advisors of Student Organizations

Lesta Burgess, Ed.D.

Introduction

Faculty advisors of student organizations have a unique opportunity to connect with students. Researchers, faculty, and parents all realize that classroom experience alone is not sufficient to assure the development of competent, aggressive leadership in tomorrow's business world (Ash, 2000). Participation in extracurricular activities has an impact on students. Floerchinger (1998) produced a list of six benefits of student involvement in co-curricular activities.

> "These benefits are: (a) increased retention; (b) improved interpersonal skills including communication and group organizational skills; (c) a positive influence on skills in leadership, communication, teamwork, organizing, decision-making and planning; (d) greater satisfaction with their college experience on general dimensions compared with less involved students; (e) useful experience in obtaining a job and providing job related skills; and (f) development of lifelong values of volunteerism and service to others as well as life long leisure skills"

Researchers have also found that students who are not involved outside the classroom in either organized student activities or jobs on campus are developmentally less mature than those who do participate in extracurricular activities. Additionally, research results have indicated that the type of four-year institution attended had little influence on the quality of the student leadership experience (Eklund-Leen & Young, 1997).

Faculty Role

Faculty play a very important role in developing a successful student organization. "Building any successful organization is difficult, but building a successful student organization is more so because the membership turns over so frequently" (Banks & Combs, 1989). This results in the faculty advisor as one of the few consistent links in an organization. An additional concern for faculty advisors is that many students are not oriented to their core curriculum classes until the beginning of their junior standing. This leaves students approximately only two years to learn the functions and operating methods of the student organization (Banks & Combs, 1989).

Many national offices of student organizations do not provide any form of guidance for the faculty advisor (Banks & Combs, 1989). He or she must develop their own skills for effective leadership of student organizations. The advisor is often left with finding a method to create, maintain and build a successful student organization. "But the advisor's role is not static; it is dynamic, changing and evolving as the student organization changes and evolves" (Banks & Combs, 1989). Many faculty advisors must compete for the student's attention with other student organizations (Rainwater, 2000). The faculty advisor must be able to promote or sell his or her own organization.

A newly created student organization often attracts many new members. The faculty advisor must be able to communicate and work with the diverse styles and attitudes of these various disciplined students. The faculty advisor should be able to connect the campus classroom with the organization and the students to create campus cultures that value co-curricular learning experiences (Culp, 1995). Faculty should develop strategies to encourage students to become involved in co-curricular activities. Participation in these activities appears to be an effective means of stimulating personal development (Eklund-Leen & Young, 1997). Students of a newly established student organization may feel they lack the skills to build a successful organization (Banks & Combs, 1989). It is the duty of the faculty advisor to promote and inform new members about the organization and the benefits of being a member.

Another role of the faculty advisor is one of facilitator. Students are capable of performing the functions and duties of the organization. What they may lack is the vision necessary for accomplishing these tasks. "To overcome their problem, the advisor is required to fulfill the role of facilitator by delegating responsibility to members to see that goals are achieved" (Banks & Combs, 1989).

Faculty and faculty advisors of student organizations should encourage students to take advantage of belonging to a student organization. "Colleges cannot force students to participate in organized campus activities or perform leadership roles. However, they can and should be accountable for creating the conditions that promote such behavior" (Kuh, 1995).

Student Organization Activities

Student organizations provide an excellent means for localizing learning experiences and highlighting the challenges and opportunities that are most meaningful to students (Ash, 2000). The diversity typical among industrial technology programs makes the task of magnetizing a group towards a central cause challenging. This challenge also presents great opportunities to draw from the many perspectives represented in a student organization. A recent review of industrial technology

journals revealed descriptions of student organization activities including: electric motorcycles, clothing sales, factory tours, crawfish boil, high school recruitment visits, concerts, and several manufacturing competitions.

The employability of industrial technology students may increase the value of student organization and business relationships. Involvement of the business community in student organizations typifies the cooperation between education and private sector that is so urgently needed. Co-curricular activities include career exploration, public service, and competitions. Student organizations provide members valuable and numerous opportunities in learning to compete--competition encourages initiative and outlook (Ash, 2000). Student organizations often focus around competitions that require industry commitments. Success in, FIRST Robotics, The Great Moon Buggy Race, or ASC-AGC National Student Construction Management Competitions, all depend largely on industrial funding and/or expertise. The combination of competitions and industry cooperation results in a mutually beneficial relationship in which students, industry, and faculty can combine resources and heighten visibility.

An annual conference provides several opportunities for students to meet peers from other institutions and participate in knowledge based contests. Contests usually require industry involvement. These contests should adequately represent various industrial technology divisions while encouraging preparation that requires the support and interest of the industry.

Building and Maintaining an Active Student Organization

The formation of a student organization is pointless if students aren't active participants. Far too many student organizations exist without a real purpose or meaning and either subsist or disappear. The key to an active and motivated group of students may be as simple as applying basic motivation theory to student organizations. McClelland's theory of needs states three major motives or needs in work situations (Babcock, 1995):

1. Need for achievement- Students, more often than faculty may give them credit for, do desire a sense of accomplishment. A project leading to competition is a sure way to motivate these students.
2. Need for power- Placing students in leadership positions enables them to learn to use their leadership skills for the good of the organization. Placing students in leadership positions solely based on a nomination or popularity vote may not be in the organizations best interest.
3. Need for affiliation- Recognizing that students are out of their element and need human companionship and acceptance increases the need for functions that involve teamwork or group activities.

Perhaps, faculty members make motivating students harder than it really is. The standard meeting, following a semblance of Robert's Rules of Order, does little to meet the aforementioned needs of students. Meaningful student involvement may take more preparation time but results in a more active student organization. Getting the students initially is the easy part, maintaining their interest involves recognizing their needs and motivation.

The traditional way to build enrollment in a student organization involves a poster on the wall or a student booth during the first weeks of class. Faculty may occasionally promote student organizations in classes with mixed results. A very effective method for building a student organization involves both faculty advisors and the student organization president. As the student first comes to a given department for initial registration advisement, the faculty or advisor informs them of the student organization and the value of student organizations. The faculty will let the new student know the chapter president will email or call them in the near future inviting them to a meeting or activity. Within 24 hours the chapter president should have contacted the prospective member and broken any barriers that might have existed between the student and the student organization. Dropping a bit of harmless personal information to the chapter president such as where the student is from adds an additional personal touch. This method places the burden with the faculty and student president, adds a personal touch, and gives the student a good first impression of the department as a whole.

Conclusion

Student organizations benefit students, educational institutions, and the industrial technology discipline. A visible student presence will add a missing component found in other successful professional organizations.

A student organization can unite students with varying interest under a single student organization or as an umbrella organization for multiple student organizations. Regardless of the adopted organizational structure a student organization can be used to promote professionalism and recognition for the discipline. Above all, the student organization should exist to meet the needs of students whatever they might be in a given institution.

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Student Article–Digital Flexographic Plate Technology: A comparison of Solvent and Thermal Processed Plates

Megan A. Chase, M.S. for Mark Snyder, Ed.D., Clemson University

Introduction

Digital direct-to-plate technology for the flexographic plate imaging process has been in development for about 12 years. It is now fairly common, especially in the narrow web market. The manufacturers of the imaging devices claim that it has many advantages over conventional imaging. The advantages are specific to the end use and can often be subjective. For the purpose of this study, a brief description of the technology is provided, along with the main differences between conventional and digital imaging.

Digital plate technology is different because the negative used in conventional photopolymer plate making is replaced by a carbon masking layer integrated into the surface of the raw photopolymer. To image the plate, it is mounted on a drum and an ablation laser is used to physically vaporize the carbon mask. Different devices will require more time for this ablation process, depending on the amount of fiber optics. The plates used in this study each took 50 minutes to image. Once the laser is finished, the carbon mask forms a negative image and the plate is ready for exposure in the same manner as a conventional plate.

The greatest difference between digital and conventional image processes is that the digital process doesn't require a vacuum during exposure. While the conventional plate is exposed through a clear plastic vacuum sheet, the digital plate is not. This could lead to a cleaner exposure without the scattering of UV light that can happen with conventional imaging. Also, some research shows that digitally imaged plates produce less dot gain than conventional plates (Spaulding, 2003).

Background

Due to the resources available in the department and the nature of a University, there is great opportunity for this type of research at Clemson. Solvent processing of flexographic plates has been done at Clemson University in the Graphic Communications department for many years. Recently, the department received a thermal processing system. Differences between the two systems were obvious to begin with because the thermal requires much less time than solvent processing. Since both systems are used regularly for research and student projects, there is a great opportunity to learn about the advantages and limitations of each. To further understand this study and the similarities and differences of the materials involved, a description of the plate making procedure is included.

Both types of plates start with a back exposure for the time that has been optimized for each. The next step is imaging the carbon layer mask with the laser engraver system. The third step is to expose the face, again at the best time for the material. Up to this point, there is no difference in the process between the two plate types. The face exposure hardens the photopolymer that is showing through the negative carbon mask. The rest is washed away by the processing. With the solvent plate, it is put in a solvent bath where, with the help of brushes, the unexposed soft photopolymer is cleaned off. This takes about 20 minutes. Then any excess solvent is absorbed with a paper towel and the plates are left in the dryer for at least two hours. The last step is a post exposure that last 10 minutes.

The thermal process takes much less time. After the face exposure, the plate is passed through a unit that uses thermal action to draw out the soft photopolymer. The machine is heated to 315°F. It takes about 10 minutes for the plate to be released from the unit. At that point the only step left is the post exposing, also for 10 minutes.

Thermal process plates have received a great deal of attention lately. Is it worth it for a company to invest in this technology? It obviously saves a lot of time but are there other advantages and disadvantages? Some publications suggest it will grow by 17% a year. This study was designed to answer questions about this new technology.

Project Overview

The target audience of this study was mainly the narrow web label flexographic market but can be applied to most flexographic products. The intent was to compare two types of plate process technologies available today. A test was developed to analyze the print quality of solvent processed plates compared to thermal processed plates. The test required designing an experimental image, producing plates, a series of printing tests and evaluation of the print tests. The trial was conducted at Clemson

University's Department of Graphic Communications. The goal was to compare the tone reproduction range of the solvent to the thermal to determine the relative print quality of each.

Identify Question

Is there a difference in print quality between solvent processed flexographic plates and thermal processed flexographic plates when using the described evaluation method? Hopefully, this study can contribute some information to help so that decisions can be made as whether there is a significant difference between the two plate types to make the investment in a thermal process system.

Limitations of the Study

As with most studies, the restriction of time, materials and other resources places limits on the amount of information that can be concluded. Here is a list of the main limitations with this study:

- Water processed plates could not be included to form a three-way comparison due to the material not being available within the time frame that was required
- The study only examined black ink results
- One line screen ruling was used in this study. To examine how both plates perform in more depth, additional screen rulings could be tested.
- The length of the press runs was much shorter than a realistic production run in industry.

The purpose of the study is to identify any differences in print quality between the plate types. The market segment in focus is the label market but this study can be applied to any narrow web process. Other benefits of this study include expanding the knowledge of the difference between plate technologies and their capabilities.

Sequence of events for the Digital Plate Processing Study

Background:Summary of findings of each type of plate.
Identify Question:
Main question to be answered by study.
Outline Study:
An overview of what the study will include.
Select Tools:
What volume Anilox Rolls, and which press will be used?
Identify Materials:
What substrate, inks, and plates will be used?
Make Timeline:
Allow for pre-press, schedule press runs and estimate when the study will be completed.
Design Test Image:
Research and design the best elements for testing in this study.
Complete Press Runs:
Run the study with the selected tools and materials within the time frame identified.
Measure and Convert Data:
Using automated spectral input and mathematical conversions
Analyze:
Using linear regression
Record conclusions:
Prepare a paper that describes the study and presents the findings.

Methodology

This study compared two types of plates that are currently used in flexographic printing. All the materials and tools used, including substrate, inks and anilox rolls were chosen because they are typical of the label market. The test image was designed for printing on a narrow-web, inline flexographic printing press. Two separate plates were made and printed to test for repeatability. The evaluation method incorporated techniques developed by the Clemson Department of Graphic Communications. The method began with automated spectral measuring and mathematical calculations to convert the data to percent dot and density. The data was then analyzed using linear regression to see what difference could be found between the tonal scales of the print from each plate.

Tools & Materials

First, tools and materials were selected. These required availability to the Graphic Communications department, as well as a good representation of what is used in the industry. Here is a list of the supplies utilized in this study.

Pre-Press
Test Image: 150 lpi conventional screening
Bump Curve: A compensation curve designed for plate type
Digital Imaging: Laser ablation carbon mask
Exposure: UV conventional Bank Light system

Narrow Web Test Run
Location: Clemson University, Graphic Communications Department
Press: 10" six station in-line, two roll with reverse angle doctor blade
Anilox Roll: 800lpi, 2.0 bcm
Sticky back: .015 medium density

Plate
Solvent: .067 digital capped
Thermal: .067 digital capped
Substrate: Polyethylene
Ink: Optimal for printing on poly

The Test Image

The test image (Figure 1) was designed to maximize the available printing area, given the limitations of the 10" press and the 12" repeat. The LPI was chosen for two reasons; 150 lpi is typical of the label market and the creators of the thermal plate material suggested that there might be limitations at or beyond 150 lpi. The elements included allowed for both visual analysis and measurement analysis.

Tonal Scale: (Figure 2) Read by the Spectrolino/Spectroscan using Spectrochart ver. 122 software to gather spectral reflectance data. All the data was then imported into Excel spreadsheet. Through the software used, the data was converted into CIELAB, density and dot area.

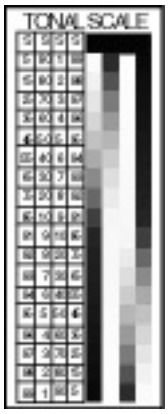

Figure 2.
Tonal Scale

Running Targets: These targets were examined during printing to insure that the same amount of impression was applied to each side. The density was read from the solid patch and adjusted until it read 1.5. The bearer bars are also important on a narrow web press for support.

Gradient: One potential problem area with flexographic printing is the hard edge that can be seen in a gradient. Any problems with either plate can be seen with this gradient that extends to 1% dot area.

Blocks: Another problem that can appear with flexo is uneven tint areas. The three blocks allow for a comparison to see how both types of plates perform with printing tints.

Full range image: It is important to examine each plate by viewing an actual image. This one has a range of highlights, especially in the grapes, but also offers full midtones and shadow areas. It is printed twice to examine any difference between the web direction print and the across web print.

Vignette: Similar to the gradient, this allows a view of how well the plate carries dots all the way to 1% dot area.

Small lines and small type: When comparing plate material, this is a good opportunity to see which one performs better when it comes to common design elements, such as type and rule lines.

Press conditions during production

The anilox rolls were cleaned with a plastic (Poly) bead system before printing. Medium density sticky back attached the plates to demountable 12-inch repeat cylinders. The ink for all runs came from the same container and measured 9.54 pH. The viscosity was tested with a number three Zahn cup and measured 23 seconds. The substrate for all runs came from the same roll.

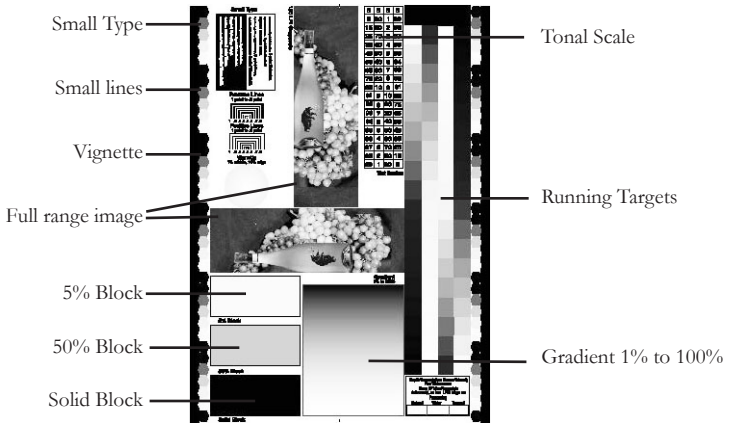

Figure 1

Measurement procedures

For each of the four runs, 16 samples were randomly selected. The sample size was formulated by the use of a statistical equation that takes into account the desired variance and the population size. This sample is based on a run of 20,000 which is a typical run size. The 16 samples were pulled from each set of printed material and labeled with the correct plate type and run number. An area in the right bottom corner of the test design allowed for recording this information.

For each sample, 36 tint patches were read using the Spectroscan. The spectral data was then converted to CIELAB by use of the Spectrochart software. The CIELAB data gives information for color, with a* as the measurement of redness or greenness and the b* measuring blueness or yellowness. The L* is the measurement of lightness, with a value of 1 as the darkest and 100 as the lightest. Since the study only used black ink, L* was the value needed. The effectiveness of using colorimetric data for print performance has been reported by Ingram & Simon, 1997.

Data Analysis

Once the data was collected, it was imported into Excel for organization and storage. From there, statistical analysis was conducted with the use of SAS. Because of the linear relationship between the dot area percent of each tint patch and the L* value, linear regression was used to compare the print of each plate. This relationship is visible in a simple graph of dot area percent and the L* values (Figure 3).

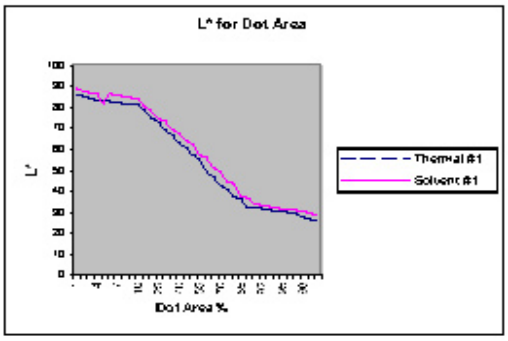

Figure 3.

First, a linear regression analysis was completed with all 36 data points to compare the whole tonal range. This was done for solvent and thermal for run number one and also for run number two. Here are the results from all four tests:

The R-Square of each test is an evaluation of how close the data fits the linear model. The ideal print quality is a completely straight line; as the dot area percent decreases the lightness, or the L* value, increases. A linear

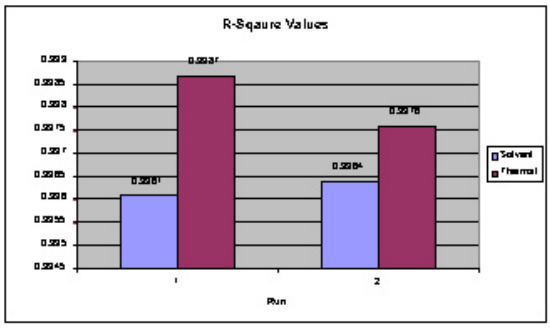

Figure 4.

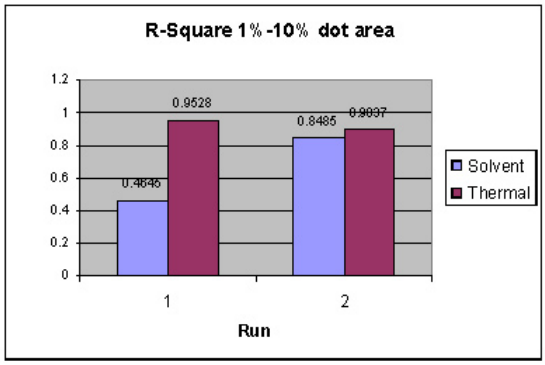

Figure 5.

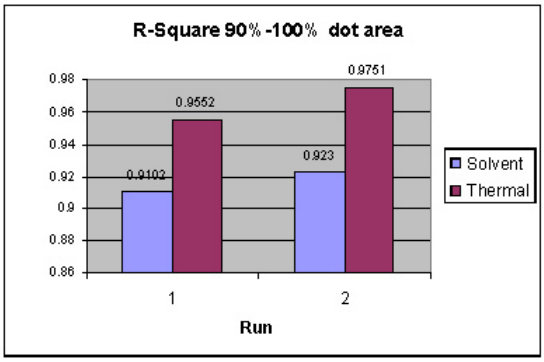

Figure 6.

relationship of the data would result in an R-Square of 1, with any value smaller showing that the data is less linear. Therefore, the print from the plate that produced the highest R-Square would suggest the better print quality.

Indeed there was a difference in the R-Square values (Figure 4). The thermal plate preformed better in both runs. To examine more specific differences between the plates, other linear regressions test were ran with pieces of the data. First, a test was conducted to inspect the highlight region, from 1% to 10% dot area. Next, the shadows were checked to see which plate performed better from 90% to 100% dot area.

The largest difference between R-Squares is found in the highlight region of the data (Figure 5). There is a

greater variation in print quality with both runs concerning the dot area percent from one to ten. Thermal is clearly superior. This is very interesting especially because it is sometimes difficult to achieve good highlights when working with flexography. The shadow analysis also showed that the thermal plate produced higher print quality than the solvent plate (Figure 6).

Another test was conducted to further understand the suggested differences between the two plate types. A visual survey was given to 25 people. They were each asked separately to choose between the solvent grayscale image and the thermal image. Both pictures were attached side-by-side on a piece of white substrate. Each image was labeled with either A or B so that there wouldn't be a bias due to the type of plate. The sample included students and faculty in the Graphic Communications department. Out of the group questioned, 14 chose solvent and 11 chose thermal.

A population proportion analysis was conducted to see if one grayscale image was preferred over another. Is there sufficient evidence to indicate that at least 50% of a population would choose the solvent image over the thermal image? The null hypothesis was $\pi \leq .5$ and the alternative hypothesis was $\pi > .5$. After calculating a Z value, it is clear to see that there isn't enough evidence to conclude that one is favored more than another.

Solvent #1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	17875	17875	8646.01	<.0001
Error	34	70.29065	2.06737		
Corrected Total	35	17945			

Root MSE	1.43784	R-Square	0.9961
Dependent Mean	58.48962	Adj R-Sq	0.9960
Coeff Var	2.45828		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	89.46390	0.41036	218.02	<.0001
dot	1	-0.60274	0.00648	-92.98	<.0001

Thermal #1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	17876	17876	25942.8	<.0001
Error	34	23.42843	0.68907		
Corrected Total	35	17900			

Root MSE	0.83010	R-Square	0.9987
Dependent Mean	55.50370	Adj R-Sq	0.9987
Coeff Var	1.49558		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	86.47966	0.23691	365.03	<.0001
dot	1	-0.60278	0.00374	-161.07	<.0001

Solvent #2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	18393	18393	9496.57	<.0001
Error	34	65.85206	1.93683		
Corrected Total	35	18459			

Root MSE	1.39170	R-Square	0.9964
Dependent Mean	58.56247	Adj R-Sq	0.9963
Coeff Var	2.37643		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	89.98295	0.39719	226.55	<.0001
dot	1	-0.61143	0.00627	-97.45	<.0001

Thermal #2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	17753	17753	14194.9	<.0001
Error	34	42.52178	1.25064		
Corrected Total	35	17795			

Root MSE	1.11832	R-Square	0.9976
Dependent Mean	56.58352	Adj R-Sq	0.9975
Coeff Var	1.97641		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	87.45209	0.31917	274.00	<.0001
dot	1	-0.60069	0.00504	-119.14	<.0001

Conclusion

The main question that was answered by this study was, "Is there a difference in print quality between solvent processed flexographic plates and thermal processed flexographic plates when using the described evaluation method?" Through the use of linear regression, a difference was observed.

When examining the final results, there are several conclusions that can be drawn:

- There are differences in the tonal scale between the thermal plate and the solvent plate throughout the whole tonal range, 1%–100% dot area.
- The linear regression analysis of both plates showed a higher R-square for the thermal plate. This means that the thermal data resulted in a smoother linear relationship, suggesting better print quality.
- The largest difference between the two plates occurred in the highlight region, from 1% dot area to 10% dot area.
- No visual difference between the grayscale images of each plate can be concluded from this study.

Further Study

By conducting this initial study of solvent processed and thermal processed plates, many other questions arise. This work has produced a platform for new research. The findings here can be taken in a number of different directions to produce more research. A few suggestions are:

- Testing different line screen rulings, both additional lpi and non-conventional screening technologies.
- Repeat the same study without the use of bump curves to see how the plates perform without any compensation.
- Additional substrates can be tested to broaden the market focus.
- Water washout plates can be added to the study to produce a three-way comparison.

Besides the conclusions above, here are some other facts:

- The same amount of time is needed to image and expose the two plate types.
- The solvent plate requires 2.5 hours to process and dry before it can be mounted to the plate cylinder. The thermal plate needs only 20 minutes.
- Solvent processed and thermal processed plates do not perform the same under identical conditions.

In conclusion, this has been a great opportunity for the Graphic Communications department at Clemson University to learn more about flexographic plate material. It's important to gain as much knowledge as possible about each material within the printing industry to raise the level of quality that is possible today. There are many different variables in any printing process. The goal is to find the right combination that works best to produce the highest-quality end product.

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Student Article–JDF: The New Workflow Standard

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Introduction

Printers are faced with ever-increasing competition and industry trends towards shorter run lengths and faster turnaround. Unstable economic conditions have also presented the challenge of keeping costs and prices low. In order to remain competitive, printers have long been searching for a method to achieve an entirely automated workflow from end-to-end. The Job Definition Format (JDF) is the long-awaited answer to print's automation challenge. Touted as the new industry workflow standard, JDF is the future of print production. JDF offers significant benefits that address the need for automating the print workflow and improving communications, but the standard must still overcome obstacles to swift, widespread implementation.

JDF is an industry standard data exchange format based upon the commercial extensible markup language (cXML) that provides control of the entire printing workflow from start to finish (ScreenUSA, 2003). JDF is not software or an application; it is a non-proprietary open data format that is available to all vendors. JDF is essentially a "giant messaging system" that provides job ticket specifications and messaging protocols to streamline information exchange, automate production, and provide a common data language for describing a print job between different systems (Brunner, 2003). Job information embedded in the JDF "piggybacks" along with a print file throughout the entire printing process in a virtual job jacket (Waldman, 2003).

Rationale for Automation

Print lags decades behind many large industries when it comes to automation. Many industrial manufacturing processes have been utilizing computer integrated manufacturing (CIM), while print has relied heavily on manual and semi-automated processes. With the evolution of JDF, print manufacturing is now evolving from a manual to an increasingly automated process. Computer integrated manufacturing is the complete connection and automation of the printing workflow. Without JDF, CIM could not exist (Whitcher, 2003). According to experts, CIM is essential for print to effectively compete and integrate with electronic media and to reclaim its "status as a leading industry in the world marketplace" (Leland, 2002).

When one considers the industry and the challenges it faces, the need for implementing a JDF workflow becomes clear. First, there is a tremendous amount of wasted time and materials in current workflows, caused by the excess of manual processes. For example, a large amount of time is wasted writing down or entering information throughout the printing process, particularly in prepress. Information is often rekeyed or rewritten multiple times, which leads to errors and redundancy (Goot, 2003). There is also a large amount of operator intervention and manual labor involved in production processes, which decreases reliability and increases time and costs (IDEAlliance, 2003).

Poor communication has also contributed significantly to waste and inefficiency in the traditional print workflow, leading to additional work, slower production rates, and higher costs (Zwang, 2001). Mistakes and delays resulting from inadequate instructions are common. A great deal of time is often wasted verifying missing or unclear customer job descriptions and production specifications (Goot, 2003). Job requests are often received in a variety of formats that are open to interpretation. MIS systems are sometimes isolated from the production system, which means that important management activities such as job tracking and scheduling are often entirely manual, leading managers to make phone calls or walk around the plant to ascertain job status and resolve problems (CIP4, 2004).

Another reason for implementing JDF is the "islands of automation" problem. Printers utilize a myriad of equipment from a variety of vendors to complete their jobs. Each vendor may have its own proprietary data language, job ticket specification, and workflow that will not interface with other equipment and systems (Bailey, 2002). Up to this time, there has been an apparent lack of standards to unify systems and a lack of cooperation between vendors. Vendors have concentrated on proprietary workflow solutions because of the lack of comprehensive standards (Adobe, 2003). The result is that some of the systems and processes are linked together while others are not. Therefore, only batch production is possible because the entire production system does not function as a coherent unit (CIP4, 2004). Machines function as individual "islands in a stream" isolated from the other areas of batch production (Whitcher, 2001). These heterogeneous systems make total automation impossible and manual intervention necessary. Not only do these disparate islands prevent automation, they also prevent open communication. Important production data that should be shared with everyone ends up as isolated pockets within the areas of batch production (Leland, 2002). According to CIP4, "most industries would find

this kind of fragmentation unthinkable in today's age of digital unification because it is inefficient, a cardinal sin in the business world" (2004).

JDF Components

The comprehensive and versatile JDF data format gives the standard its powerful potential to eliminate or reduce all of the current inefficiencies in the printing industry. JDF consists of three basic components: the job ticket specification, management information system (MIS) function specifications, and job messaging format (JMF) standards. The job ticket specification includes all of the information and instructions for a print job such as quotes, preflight reports, ink settings, as well as number and format of pages. The JDF MIS function allows important business data such as labor costs, production times, and material usage to be collected and closely monitored. JDF standards do not provide a MIS, only the specifications necessary to interface with a company's particular MIS system. The job messaging format provides a common command and control language for all equipment device controllers which creates the structure needed for computer systems to communicate and understand one another. JMF is bi-directional, allowing for open communication between all components of the workflow system. Instructions, information, and notices are delivered to equipment and personnel throughout the entire production cycle in real-time (IDEAlliance, 2003). See Figure 1.

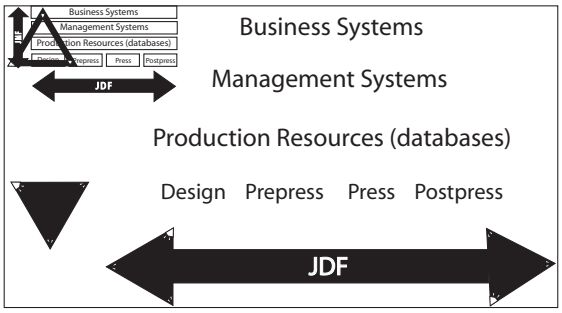

Figure 1.

Originally created in 1999 by a joint effort between Adobe, Agfa, Heidelberg, and MAN Roland, JDF was given to the International Cooperation for the Integration of Processes in Prepress, Press, and Postpress (CIP4) for further development (Whitcher, 2001). CIP4 is an international standards body based in Switzerland that consists of over 170 print vendors, consultants, and printers worldwide. The overall purpose of CIP4 is to encourage the computer-based integration of all printing processes (CIP4, 2004). JDF was given to CIP4 to ensure that it would become a universal, non-proprietary data format that would benefit everyone (Creo, 2003). JDF combines and builds upon the existing technologies of Adobe's front-end Portable Job Ticket Format (PJTF) and CIP3's back-end Print Production Format (PPF). The new JDF standard is fully compatible with these older formats and is intended to work in conjunction with a PDF-based workflow (Leland, 2000).

The technical specification for JDF is lengthy and complex, but its basic operation is straightforward. JDF manages information through a hierarchy of jobs and processes (Brunner, 2003). Each step in the job process is translated into a data node and each data node is defined in terms of inputs and outputs (Leland, 2000). Inputs contain both "intent" and "process" information that describes the intended output for the job. "Intent" information includes the basic job descriptions entered by the customer and the detailed production specifications entered by production planners, while the "process" information contains the data needed to operate equipment and produce a product (Harvey, 2003). Outputs are the end result of the process specified by the input. The output of one process often becomes the input information for another process. The output for the trapping process, for example, would provide an input for the platemaking process (ScreenUSA, 2003). While some specifications must be entered manually, most are collected automatically from system settings (Harvey, 2003). As the job travels through the workflow, it collects information and metadata that is used to control production equipment. For example, color settings collected during the prepress stage will automatically set the ink keys on a press to achieve optimum color values. All of the individual nodes created during the production process form a tree that describes the entire product and workflow (Leland, 2000).

Benefits of JDF

The JDF format offers three key benefits in addition to the obvious benefits of unification and automation of the entire printing process. One of these key benefits is the elimination of the communication gap between production systems and MIS systems. With tight integration between production and a good MIS system, management will have increased control over the production workflow and more information at their fingertips. A JDF MIS system will allow for improved job tracking capabilities. Management will know the status of a job at all times because they will be able to track the progress of a job in real-time (Brunner, 2004). This information can be reported directly to the customer and then used to evaluate how long a job took to produce in each area. JDF MIS systems also allow for the

collection of detailed production data without disturbing production personnel to get information (ScreenUSA, 2003). Management can analyze this data to assist with cost analyses and to determine where waste and delays are located (Bailey, 2002). This data will be instrumental in the effectiveness of management's planning and process improvement efforts.

Another key benefit of JDF is improved information exchange and streamlined data entry. JDF integrates both production and information systems, which makes detailed job information available to employees throughout the production process. Since information is stored electronically, it only has to be entered once. This eliminates the need for rekeying information and reduces errors, processing time, and information redundancy. The elimination of manual entry tasks frees up additional time for more important tasks as well (Bailey, 2002). Once entered, the information will follow a job throughout the entire workflow. Automatic notifications regarding job progress, changes, and questions can be sent to the appropriate parties for verification (ScreenUSA, 2003). JDF allows for parallel processing of information by multiple people, ensuring that everyone will have access to complete job data at all times (Bailey, 2002). Parallel processing also prevents conflicting instructions and duplications as well as reduces delays caused by waiting for job information. According to Martin Bailey, CEO of CIP4, the JDF system provides a clear and complete description of what has been done on a job and what the final product should be. Any problems or discrepancies between the actual and quoted job can be identified and corrected immediately. A clear and unambiguous job description will be invaluable to avoiding costly misunderstandings and delays (Bailey, 2002).

The final key benefit of JDF is that it provides the flexibility to adjust to any type of workflow. When it was created, the goal was to give JDF the flexibility to fit any print operation by using XML "building blocks" that will emulate any workflow (Smith, 2003). Since JDF is extensible, it can be customized to meet the needs of specific production environments no matter how simple or complex. Printers of any size can use JDF, from small shops to large commercial printers and publishers (Adobe, 2003). A variety of heterogeneous equipment can now be used to print a job because of the common data language. This offers a much larger selection of equipment solutions to printers that will connect to existing systems (Bailey, 2002).

Also, customers, suppliers, and printers will be tied closer together than ever before because JDF supports e-commerce. The printer will be "linked to the customer's desktop," making it possible for customers to transfer a PDF file and JDF job ticket directly into the printer's workflow (Waldman, 2003). Detailed production specifications can then be added during prepress, and the job can move directly into production. Production information collected by the MIS can be used to order supplies from vendors. Multiple production facilities and print partners can be linked together into a continuous production chain via the internet. For example, remote proofers could be installed at major print client locations, speeding the approval process (Bailey, 2002). With the JDF workflow language linking these different systems and facilities, the same product should result at all production locations. JDF even offers the potential to automatically configure a print workflow based on the job ticket. Jobs can be routed to available devices automatically as they are received (American Printer, 2003). In short, the flexibility that JDF provides offers unprecedented integration of all parties and systems. JDF allows for closer interaction with clients, improved support from vendors and partners, and the creation of a continuous supply chain.

Barriers to Automation

Despite the tremendous benefits that JDF offers the printing industry, it must still overcome several obstacles that prevent swift and widespread adoption. One of the major obstacles that JDF currently faces is that it is not yet "plug-and-play" (Smith, 2003). JDF will definitely work if all equipment comes from one vendor, but any time equipment from different vendors is used, the chance of the system not working seamlessly increases (Smith, 2003). Integration and testing time is required before a smooth workflow can be achieved. The XML standard may be universal, but agreement must still be reached on cabling, networking, and connectors. Getting through firewalls and accessing proper data ports are just a few networking issues that will have to be addressed (Harvey, 2003). Increased vendor cooperation will be essential to the success of standardized JDF systems. Also, there is currently no formal testing procedure in place to ensure JDF compliance. Therefore, users cannot be certain of a particular product's interoperability. CIP4 is aware of this shortcoming and is working diligently to create testing procedures and a database of products that are interoperable (Smith, 2003). JDF does work in today's print production environment, but time will tell whether or not it will be truly "plug-and-play."

Another major obstacle to implementation that JDF faces involves the adoption of JDF-enabled equipment. In order for a JDF workflow to be realized, all of the software and hardware within the workflow must be JDF-enabled. Many vendors have begun producing JDF-enabled equipment and systems; prepress vendors embraced JDF quickly, and press and bindery

manufacturers are following suit. There appears to be momentum behind the adoption of JDF by printers and vendors, but most printers have yet to invest in the technology (Smith, 2003). Printers are uncertain of how to integrate JDF into their current operations. JDF can be adopted slowly as part of the natural upgrade cycle or quickly as part of a complete reengineering process (Smith, 2003). Prepress has integrated JDF into its workflow more rapidly, which is probably due to the shorter equipment and software upgrade cycles (Bailey, 2002). New equipment purchases made today and in the future will likely be JDF-enabled. During the standard upgrade process, printers may find that they have amassed a collection of JDF-enabled products. Existing equipment that uses the PJTF and PPF data formats, as well as tracking systems such as INFAtrack and PrintTalk, will be fully compatible with JDF (CIP4, 2004). However, the speed of integration will be slowest when large, expensive equipment has to be replaced or modified (Bailey, 2002). Few presses built before 1995 will support JDF (Romano, 2003). Also, a great deal of existing bindery equipment has no capacity for connecting to a JDF production workflow. Computer consoles can be configured into such machinery to display job information or JDF controllers could be installed, but the process may only be semi-automated (Bailey, 2002). The sheer expense of replacing or modifying large pressroom and bindery equipment may prevent JDF from penetrating these older production areas anytime soon.

Interestingly, some of JDF's basic technical specifications create obstacles to its adoption. Put simply, some people are not entirely satisfied with the current state of the JDF specification and they will wait for the next version. The extensibility of JDF raises concerns with some industry experts. While extensibility offers the ability to customize JDF to suit specific needs, it can lead to problems. Users can add their own XML elements and attributes to the JDF language, but these extensions must be validated. In order for third party vendors to integrate extensions into their solutions, all JDF extensions must be documented and communicated to the vendor. Furthermore, CIP4 uses metric units as the defaults in the JDF specifications, and any change or customization to the metric defaults could lead to "undefined behavior" in JDF. The JDF workflow is also based on a "network database" rather than a central database. According to the JDF specifications, data transactions occur across a networked environment and do not flow back to a central data store. William Ray, president of Group InfoTech, believes that the process will be difficult to control without a central data store location. In Ray's opinion, data should always have to flow back to a central location to manage the process (Smith, 2003).

Finally, the adoption of JDF may be slowed by the fact that it creates a fundamental change in the print infrastructure (Harvey, 2003). Large, medium, and small printers alike will have to undergo a significant paradigm shift with the introduction of a JDF workflow. Ray states that printers will have to reorient their thinking from being printers to data processors (Smith, 2003). Printers must realize that print is no longer a craft, but a manufacturing process. James Kosowski, president of Rapid Impressions in Broadview, IL, believes that print is evolving into a manufacturing operation requiring much less skilled human involvement (Leland, 2002). This fact may have significant impact on skilled print employees in the future. Fewer people may be needed to run production equipment and employees may need to be retrained. JDF will bring clients and printers closer together than ever before and this fact makes some printers nervous. Printers fear that customers will be given more power to drive the print production process, but must accept that the client's workflow will become a part of their own (Harvey, 2003).

Conclusion

With time, many of the obstacles to implementation will likely be overcome and JDF will be adopted. The future of JDF appears bright and all signs are pointing toward widespread acceptance. CIP4 is currently finalizing JDF Version 1.2, and work has already begun on Version 1.3. JDF 1.2 addresses some of the current technical issues and incorporates new processes, such as preflighting and asset delivery to control the movement of digital files between different locations (American Printer, 2003). The new versions will be backwards compatible with previous versions (Whitcher, 2003). JDF 1.2 will be introduced at Drupa 2004, which many vendors are calling the "JDF Drupa." Printers are becoming more interested in JDF's powerful potential, and CIP4 is concentrating its efforts on getting JDF products into print facilities to ensure everything works well together (American Printer, 2003). Increasing numbers of vendors are offering JDF-enabled products, and these numbers will continue to grow. Many vendors will be introducing JDF products at Drupa 2004, and hundreds of devices will likely be available within the next year (Whitcher, 2003). Experts think that JDF is still several years away from adoption but feel that JDF is the long-awaited answer to print's problems. David L. Zwang believes that JDF is 3-5 years from widespread adoption but says the industry will ultimately adopt JDF (Smith, 2003).

With the present and future challenges of increased competition and trends toward lower costs, faster turnaround, and shorter run lengths, automation is the only way that printers will be able to remain competitive. Disparate production systems and equipment have

prevented printers from achieving the goal of total automation. The printing industry has found the long-awaited answer to its automation and communications problems with the introduction of the Job Definition Format. JDF is the new industry standard workflow that offers powerful benefits to printers, customers, and vendors. There are currently a number of obstacles to the swift adoption of JDF, but CIP4's efforts to improve and integrate the technology continue. Experts believe that JDF will eventually be adopted because of the need for a comprehensive standard that benefits everyone. Put simply, JDF is the future of print production.

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Student Article–Network Security in Graphic Communications

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Introduction

In today's high-speed market, connectivity provides a fast, constant flow of information through computer networks. This information flow allows people to exchange information faster and more efficiently than ever before. The Internet revolution is allowing constant interaction regardless of location enabling companies to keep vital information in the hands of the people who need it most and make better, more informed decisions faster than ever before. With these abilities, however, comes the even greater task to protect the information. These methods of security come at a high price of dependability on fallible machines, which, through an unplanned outage, malicious activity, or some employee not paying attention, can go from connecting a company, to crippling a company.

In the Printing Industry, Network Security is very important. Printing companies want to protect, not only their own information but also their clients information. Large corporations and businesses send their financial reports to be printed with the expectation that the Printer will do what they can to protect it from the outside world while completing the job. Without this protection, the Printer would suffer the loss of a big client. Please keep this in mind when reading about the different ways to secure a network.

Local Area Networks

The most common networks are Local-Area Networks (LANs). In a LAN, computers are connected together within a local area, such as an office or home. Originally, only medium to large-sized businesses could afford the cost of networking hardware and software. However, today's technology has changed this. The affordable price and added convenience of having a LAN has made it commonplace to see networks in many homes and offices. Each computer in a LAN is able to access shared files and devices anywhere on the network. This makes sharing of expensive devices, such as laser printers or large storage devices, a cost-effective alternative to purchasing a device for every user. (Furdyk)

Today, the vast majority of LANs are based on Ethernet standards. One can choose from 10Base-T Ethernet (10Mbps), 100Base-T Fast Ethernet (100Mbps), or 1000Bast-T Gigabit Ethernet (1Gbps). 10Base-T Ethernet is used commonly used for home and small office networks (SOHOs), because it is cheap in cost provides sufficient performance. For large businesses, a 100Base-T Fast Ethernet solution may be required if there are a large number of computers connected to the network, or if large amounts of data is frequently transferred. Currently 1000Base-T Gigabit networks are primarily found at colleges and research institutes where high network speed is necessary to support a very large number of concurrent users. (Furdyk)

There are three types of cabling for Ethernet networks: coaxial, unshielded twisted pair (UTP), and fiber optics. Of the three cabling types, UTP is the most popular type of cabling, because of its wide availability and low price.

Ethernet Network Hardware Components

Ethernet networks can make use of hubs, switches, routers, and/or bridges. The hub is a hardware device that all computers on a network are connected to and manages receiving and transmitting data from networked devices. Hubs come in many different port configurations. Workgroup hubs mainly come with 4, 8, or 12 ports. Enterprise hubs can be purchased in 24 and 48 port configurations, and each port supports a single 10Base-T or 100Bast-T connection from a PC or peripheral. There are both manageable hubs, which allow advanced configuration of hub properties via a software package, and standard hubs (which are cheaper) and are usually used for home or small office networks. The main disadvantage to a hub is that it only allows for one speed on a network. For example, if a network has ten computers running at 100mbps and one running at 10mbps, the whole network will run at 10mbps. (Furdyk)

Switches work much like a hub, only faster. Where a hub can only handle one instance of the speed of the network, a switch can provide the speed of the network to each individual port. Thus, a 48-port switch on a 100Bast- T Fast Ethernet network provides up to 4.8 gigabits per second of throughput. Bridges are devices that connect two different networks that use the same protocol. In bridging networks, computer or node addresses have no specific relationship to location. For this reason, messages are sent out to every address on the network and accepted only by the intended destination node. Bridges learn which addresses are on which network and through the building of a basic routing table, so that subsequent messages can be forwarded to the right network. A router is a hardware device or, in some cases, software in a computer, that determines the next network point to which a packet

should be forwarded toward its destination. The router is connected to at least two independent networks and decides which way to send each information packet based on its current understanding of the state of the networks it is connected to. (Feghhi)

Network Operating Systems

Network operating systems form the backbone of larger Local Area Networks and their security. For medium- sized to larger environments there are several server based options: Novell NetWare, Sun Solaris, UNIX, Linux, Caldera Open Linux eServer, Cybernet NetMAX Professional Suite, Red Hat Linux, and Turbo Linux Server, OSX Server and Microsoft Windows NT or 2000 server. A number of different methods can be used to share files, including Microsoft's Common Internet File System, and Sun's Network File System. (Wong)

For smaller Local-Area networks, server based networking operating systems may be excessive and too expensive. Some multi-purpose operating systems, such as Windows NT/2000, come with capabilities that enable them to be described as a network operating system. If the network requires minimal security and provides only basic services, a peer-to-peer LAN network may suffice. In a peer-to-peer network, individual workstations are connected to one another to share files, peripherals, and even Internet access without the need of a central server. Windows 95/98/2000/XP, and Mac OS X both provide support or peer-to-peer networking, are easy to set up and maintain, and are a very inexpensive solution (Wong)

Security of Networks

There are some security disadvantages to a peer-to-peer network. The security features are more limited in the consumer products. Each service, such as a shared printer, is secured with a single password, and password communication over the network is relatively insecure compared to the network operating systems. The major advantages are price and simplicity, making peer-to-peer networking the option for smaller businesses and the home. The use of a reliable firewall and updated virus protection software are highly recommended. (Wong)

Foreseen Future of Network Security

Looking towards the future, many companies are designing better and more secure software, but it is slow progress in what is still an emerging sector of network technology. Building better software is important, because most attacks at networks are aimed at known weak spots in the applications and operating systems. To block such attacks, software and hardware vendors are working together to better integrate their products. Security management vendors such as ArcSight, Computer Associates, e-Security, Intellitactics, netForensics, and Symantec, are working feverishly to develop capabilities to analyze how software flaws and hacker techniques can threaten networking systems. Microsoft's huge base makes it the prime target of choice for hackers. Microsoft has responded to the growing number of attacks with a $100 million initiative to improve the security of its software and reduce the number of software updates and security bulletins it has to issue. That includes putting thousands of developers through ten weeks of extra training to improve software design. (Feghhi) Nortel, Symantec, NetScreen, and others are developing multipurpose network-security appliances. The goal is to run all network traffic through an appliance that consolidates many security applications so they operate faster and easier to manage. These devices will gain prominence by 2004, because they will increase security while reducing costs. (Wong) Security vendors are working to improve integration among the various security applications on network platforms, which include firewall, intrusion-detection systems, antiviral systems, and vulnerability assessment functions. (Hulme)

Password Security Issues

To help maintain a secure network, password security policies should be implemented and strictly followed. If someone really wanted to get into a network, there are software tools called password crackers that allow individuals to "steal" a user's password. Statistics show that 70% of passwords are actually the word "password." (Password Security.) This means that at any given time, anyone can go to 70% of all computers and type in the word password and access potentially sensitive information. Usually when picking usernames and passwords, people pick easy words to remember for example, people often use their name, their dog's name, their child's name, street name, birth date, or social security numbers. This may be a little harder to crack than "password," but are still among the easiest. Crackers need only to find out a little information about the user and then the user's password is no good. (Password Security.)

Passwords that use just the letters of the alphabet are also easy to crack, even if the password is not a word and does not make any sense. With available cracking software, just using letters of the alphabet is not a secure enough password. The use of a cracking software takes the cracker into a series of steps. First, it will run the target password through its default dictionary. If the password is in the dictionary, then the password is cracked. If the password only contains letters, the password will be cracked within a fraction of a second. If the password contained letters and numbers, it would take the software only a couple of minutes to crack. If the password contained both upper and lower case letters, it would take about a half a day. If

it contained upper and lower case letters and numbers, it would take about a day or two. The hardest password to crack would be one that contained letters, numbers and special characters (such as !, @, #, &, etc). This could take a cracker about three months to crack. Which is why every network should make a habit of changing their passwords every three months. The more characters and the longer the password is, the more protected it is.

It is certain that having a strict password policy that is enforced by company policy would only help in securing the network and its contents. An example of a policy would be requiring the password to contain letters, numbers and special characters. This password would also have a required minimum length of 10 characters and would be changed every three months. This would increase the likelihood that the network is safe from someone cracking into the system.

Firewalls in the Network

The term "firewall" is already a buzzword in computer literature. Marketing strategists for Firewall developing companies have generated a straightforward association in the mentality of budget administrators: "We have a firewall in place and therefore our network must be secure". However, total reliance on the firewall may provide a false sense of security. The firewall will not work alone (no matter how it is designed or implemented). The firewall is simply one of many tools in a toolkit for IT security. To better secure networks, intrusion detection systems (IDS) have been developed. An intrusion detection system is basically a system that detects burglary attempts by looking for uncommon changes or activities in the network.

Intrusion Detection Systems

Some of these tools check email content and perform a threats analysis and antivirus scans that remove all types of email- born threats before they can affect your email users. Advanced tools include multiple virus engines, email content and attachment checking, and an email threats engine, which together analyze and defuse HTML scripts, .exe files and other harmful email items. Other tools check your network for all potential methods that a hacker might use to attack your network (open ports, exposed web servers, non- updated system patches, etc). By analyzing the operating system and the applications running on your network machines, these tools can determine all the possible security holes in your network. In other words, it plays the devil's advocate, and alerts you to weaknesses before a hacker can find them.

Intrusion Systems such as Data Sentinel, GFI LAN guard, and Tripwire for Servers are using newer technologies, which allow them to detect alterations to important system files and assets. Some tools retrieve all event logs from servers and workstations and alerts the administrator of security breaches for immediate intrusion detection. These

programs can alert you about significant security events happening on your workstations

and servers (for example, a user attempting to log on as an administrator, or a person

being added to the administrator group). It is very important to always be aware of anyone trying to tamper with the system. Security should never be taken lightly, nor should it ever be ignored. So, making sure that the network is secure beyond just a firewall is very important.

Backup Systems

In spite of all preparations and precautions, sometimes a network will fail anyway; therefore a data backup system is a must have in order to minimize the loss. There are several options depending on the amount of data to be backed up and the value of the backed up data to the business. Smaller backup systems can be used on individual computers for immediate security. Iomega's zip drive, which can hold up to 750 MB on asingle disk, CD burners, which can hold up to 800 MB on a single disk, and new DVD-RAM, which can hold up to 9.4 Gigabytes (9,400MB) are the most common options for this because of their cost and ease of use. For a more reliable system, most business will back up their entire network onto a high capacity device, such as magnetic tape. A magnetic tape backup system uses magnetic tape cartridges that can hold up to 100 GB and will last as long as the media is cared for(Fontana, Connor). This option allows the network to be backed up in one file, during off peak hours, on a regular automated schedule and archived for long periods of time. For example, a print shop can close at 9:00PM, and backup their graphics files, accounting information, wage information, scheduling and employee files at 11:00PM, by the backup system on site. This allows a system administrator to eliminate the need for someone to remember to back up the system manually, and the ability to back up a network with out slowing it down.

It is important to also establish a system for storing the back up disk created. It does no good to back up a network and store the backup disk on site, because if a truly catastrophic event were to hit the site, the backup disk would be destroyed as well. There should always be a neutral site, some geographic distance away, to allow for maximum protection of all information. Many storage companies, such as Docusafe and StorageTek, offer pick up and secure off site storage of tape media for a monthly fee(Leung).

Networking, when done well, can provide a powerful tool, exponentially raising the productivity of workers and businesses in different industries. However, when

done wrong, it can make the job process as slow and time consuming as manual work. Truly effective network security protects the business against all forms of data loss, malicious or unintentional, from outside the company or inside, and always provides a backup for information that is lost despite prevention methods. A careful attention to these details is the very things that divide the successful businesses from the bankrupt ones.

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