

Visual Communications Journal 1998

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Visual Communications Journal

1998

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Editor's Note

This year's *Visual Communications Journal* provides a wide-variety of articles dealing with graphic communications technologies and methods that we can use to teach those technologies to our students. If you're interested in new concepts to teach your students, be sure to read Lord's article about Singo's Strategies for Set-up Reduction (page 15), Hsieh's piece on Measuring Dot Gain from File to Plate: Murray-Davies or Yule-Nielsen Equation (page 24), McLaughlin's Pollution Prevention: Opportunities for Academia and Industry (page 48), and Lantz and Baggett's paper on Virtual Reality Movies (page 54).

If you'd like to know more about the way faculty members are disseminating information to their students, read Liedke's piece on Corporate Training and Consulting/Beijing (page 1), Kellogg and Spotts' experiences in The Network Server: An Educational Tool for the Graphic Arts Classroom (page 31), Henke's Considerations for Computer-Based Instruction (page 42), Lee's Instruction-On-Demand—The New Era of Computerized Instruction (page 18), and my paper, Teaching Students About Color Management (page 7).

This issue of the *Journal* also includes a paper that is important to all of us—Student Recruitment: Crisis or Opportunity (page 37). In this article, Dailey describes the results of a research study that he conducted that can shed some light on an extremely important issue—recruiting a sufficient number of bright students to keep our classes full and meet the needs of industry.

Sometimes we get so caught up in the relentless pursuit of changing technology that we may become discouraged. I know that I just about had a heart attack when I learned that Photoshop 5.0 was to be released to the public just six months after my Photoshop 4.0 book was published!

To counteract our frenzy, I think it is necessary to step back a bit and consider how important the printing and publishing industries are to society and how vital we graphic arts educators are to the printing and publishing industries. Njaka reminds us of the importance of the printed word in his paper about The Technology of Book Production (page 21). He wrote "...a book can be described as a more or less

coherent body of graphic communication assembled into one of several units for the purpose of systematic presentation and preservation of lastingly valuable material." Consider the adjectives he used: systematic...presentation...preservation...lasting...valuable. What greater power could there be than the ability to create products that are thus described? And, what greater responsibility could one have than the task of teaching people how to use that power?

You could, of course, make the point that we are obviously bias in favor of our chosen profession. However, it is nice to know that we are not the only ones who believe in the power of print. In fall 1997, *Life* magazine published a special issue that ranked the top 100 events of the millennium. Among all the possible occurrences between the year 1001 and 2000, *Life* chose Gutenberg's printing of the Bible as the single most important event. To quote from the story:

OF ALL THE millennium's technological revolutions, the most far-reaching started just before the era's midpoint. Throughout history, the ability to read and write had been confined mostly to tiny elites of nobles, priests and scribes. But in the 15th century a literate middle class arose in Europe. Its hunger for knowledge led inventors to seek a way to mass-produce the written word. And when German goldsmith Johann Gutenberg succeeded—creating his masterpiece, a run of 200 gorgeously typeset Bibles, in 1455—*he unleashed an information epidemic that rages to this day* (italics mine).

The article concludes by stating:

An acceleration of the Renaissance was only the first by-product of the Gutenberg press. Without it, the Protestant movement might have been stillborn, as well as the industrial and political revolutions of the succeeding centuries...

We are important people doing important work. Sometimes, while we are running full speed ahead just to keep up with technology, our value is worth remembering. Thank you, *Life Magazine*, for helping us remember.



Corporate Training and Consulting / Beijing

Dr. Jane A. Liedtke, Professor
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Introduction

Innovative partnerships are the benchmark of success in China today. U.S. companies are entering the Chinese trade arena with great anticipation and high expectations of success. Companies new to international business in Asia soon discover that their marketing and sales techniques are not adequate, manufacturing practices suffer from employees lacking prior involvement in Western production and operations techniques, communication between management and employees is insufficient to meet corporate goals, and frustration becomes evident as firms struggle to make investments pay off. Much has been written about the problems encountered by U.S. firms conducting business and establishing manufacturing joint ventures in China. Each case study and scenario points to the need for extensive training and preparation of both the Chinese workforce as well as the U.S. expatriate managers assigned to assist the company in making the transition from a state-run factory to a cooperative and viable world-class business.

The Bureau of Foreign Experts of the State Council in China has recognized that increased use of foreign technical and management expertise is essential to meet Central Government goals and plans. They have called for an increased use of foreign experts by business, industry, and education to meet the need to improve China's technological capabilities. In addition, the Central Government has a heightened awareness of the role that foreign educational institutions can play in this process and is encouraging U.S. institutions of higher education to provide programs, courses, and degrees in China.

Project Focus

CONCEPT:

Illinois State University and China International Publishing Group (CIPG) will open a Center for Corporate Training and Consulting in China's capitol, Beijing, for the purpose of providing corporate management training to employees of Sino-U.S. joint venture companies located in the region. The

Center will also serve to assist small-to medium-sized U.S. firms partnering with Chinese companies who do not have the staff or resources to conduct the extensive employee training and technology assessments essential to economic success in China. Technology assessments would promote the import of U.S. manufacturing equipment and technology to China as a means of improving the productivity and efficiency of Sino-U.S. joint venture manufacturers and businesses. A broad range of businesses and industries will be served through the Center for Corporate Training and Consulting by working closely with U.S.-Sino joint-venture firms to meet their short-term and long-term training needs.

By improving the quality of the workforce employed by Sino-U.S. joint venture firms, the corporate users of the Center will benefit from:

- the reduction of the cost to deliver an extensive array of management and industrial training programs needed by Sino-U.S. joint venture firms.
- access to high quality training programs and world-class training facilities.
- improved interaction and communication between U.S. expatriate managers and Chinese management employees, workers, and staff members.
- customized training programs for any number of employees—a feature especially attractive for small to mid-sized companies entering the China market.
- decreased time to gain a workforce familiar with Western approaches to business, management, and industrial production/operation systems.
- increased efficiency and productivity from domestic employees.
- increased capability in manufacturing and marketing/sales.
- improved profitability yielding increased export of U.S. manufactured goods into China.
- an opportunity for train-the-trainer sessions to improve in-house training capabilities.

The net result is an improved workforce capable of yielding positive economic conditions for the participating firms and, thus, increased trade possibilities.

PROJECT GOALS

- Meet the short-term and long-term training needs of Sino-U.S. joint venture companies in the Beijing region.
- Set-up and operate a world-class training center for business, management, and technical training.
- Offer seminars, workshops, and short courses at the center with ISU faculty trainers and eventually utilize Internet capabilities to provide distance learning options.
- Offer basic and advanced certificate programs and courses from Illinois State University.
- Offer consulting services to Sino-U.S. joint venture companies in Beijing and conduct technology assessments to yield increased U.S. exports to China.
- Increase the consulting and training opportunities for ISU faculty in Asia, especially in China.
- Provide CIPG with the opportunity to gain access to high quality management training and the experience of ISU faculty.
- Improve the adult education facilities of CIPG and the capability to deliver to CIPG employees training via the Internet.

PROGRAMS

A variety of high impact seminars and certificate programs will be offered as one-, two-, three-, and four-week sessions including such topics as: Total Quality Management, intercultural communications, technical communications, team building, production and operations management, Agile Manufacturing, ISO 9000, information systems, and computer control systems. (Masters of Business Administration) MBA content will be delivered via mini-courses and seminar programs. Programs will target the needs of Sino-U.S. firms in the Beijing region based on contacts with these companies and through the U.S. Department of Commerce at the U.S. Embassy, the American Chamber of Commerce in Beijing, and the U.S.-China Business Council located in Beijing and Washington, DC. In addition, baseline information will be used from a Gallup Research Survey conducted in China to assess the training needs of U.S. corporations on behalf of the U.S. Department of Commerce and the

U.S.-China Business Council (comprised of U.S. Fortune 500 firms doing business in China).

Programs will be delivered and services provided by Illinois State University faculty who are experienced trainers and consultants with business and industry in the U.S. and internationally. These faculty will be selected based on their knowledge of the seminar/certificate program subjects as well as their intercultural capabilities. Working with the Center will also increase the number of faculty at Illinois State University with China experience and serve to provide an exceptional professional development model at the institution. Translation and interpretation services will be provided by CIPG staff assigned to the Center. As the training Center's capability evolves and international Internet and telecommunication systems improve with China, distance learning techniques will be employed for the delivery of appropriate courses.

Illinois State University has an outstanding faculty offering degrees and programs in International Business, Master's in Business Administration (MBA), International Trade and Economics, Accounting, Management, Marketing and Sales, Industrial Management/Technology, International Communications, and Applied Computer Science. It is anticipated that faculty representing 18 Departments will participate in program offerings at the Center. The Center will be Directed by an ISU faculty member, Dr. Jane Liedtke, living in Beijing and working directly with CIPG's Office of International Cooperation and Adult Education Program and Facility Director. In addition, three out-reach offices on the ISU campus will be used to facilitate the recruitment and preparation of faculty serving the ISU-CIPG Center as trainers. They are: the Office of International Studies and Programs, the Office of Technology Transfer and Corporate Services, and the Center for Information Systems Technology.

BENEFITS TO ILLINOIS STATE UNIVERSITY

Increasing business contacts and opportunities in China will serve:

- **Faculty**
 - Asian experience for faculty in 18 departments at ISU.
 - Consulting and corporate training experience.
 - Contacts at Sino-U.S. joint venture companies.
- **Students**
 - Faculty members with Asian knowledge and experience.
 - Internships for undergraduate and graduate students at the Center.

International Business
Industrial Technology – including printing
management and publishing
Management and Marketing
Business Education and Administration
International Communications
Economics – International Trade
Foreign Language – Chinese
English – Technical Writing
English as a Second Language
Business contacts for Asia positions.

- **ISU Community**

Campus-wide venture to increase Asian activities and recruit potential undergraduate and graduate students in China for ISU degree programs in the U.S.A.

Why Target Such a Project?

First, there is a growing need for business and corporate services, especially training, in China for Sino-U.S. joint venture companies. That need requires attention from both U.S. corporations, the government, and educational institutions as well as Chinese businesses and government organizations. In order for Sino-U.S. joint venture companies to be technologically competent and economically viable, their workforces must be prepared to work with new systems and equipment. As companies improve their workforces, they become more productive and their profits increase. Increased profits, in part, enable companies to purchase additional U.S. products and allow companies to increase worker salaries. Increased salaries, in turn, spur consumer demand for more Western-produced goods. This model supports the interest of the U.S. government to increase the export of U.S. goods to China to improve the balance of trade. In addition, it supports the Chinese government's desire to improve state-run businesses and make them successful self-sufficient corporations that will be attractive ventures for foreign investment. Products produced by Sino-U.S. joint ventures will improve in quality as a result of a better prepared workforce when both management and labor are in tune with management and quality trends. In this case, everyone in the trade arena wins.

Second, Illinois State University has yet to achieve its full potential in providing education and training leadership in Asia. We have already built three successful student-faculty exchange programs in China: a) CIPG in Beijing, b) Beijing Institute of Printing in Daxing County, and 3) Liaoning Normal University in Dalian. While efforts have also been successful to deliver training and advanced degree programs in Thailand, and

new initiatives have begun to bring students from Korea to the ISU campus, little has been done to enable faculty to advance their ability to deliver training and consulting in Asia. This project will strengthen a larger number of faculty in terms of their capability to provide a global perspective on business and industry as well as increase their knowledge of intercultural and multicultural learning. It will also extend opportunities to students in a variety of majors and will provide graduate and undergraduate students opportunities for internships and employment in Asia. As an institution with programs in international business, industrial technology/management, intercultural/international communications, and international trade and economics, it is essential that opportunities be available for faculty and students to further experience Asia, specifically China, as the Pacific Rim's leader in the next century.

Third, but not least, CIPG has an opportunity, through this cooperative venture, to benefit from the expertise of ISU's faculty and training programs. In particular, CIPG will benefit from increased business, management, and marketing capabilities. The project will also provide the venue for other Chinese firms engaged in joint ventures and international trade to improve their workforces. By hosting this Center within their facilities in Beijing, CIPG will demonstrate, through an innovative cooperative project, a model for effective and efficient business operations—that is, cooperation, utilization of external resources, and continuous improvement. The updating and upgrading of adult education classrooms at CIPG to a world-class training facility will also provide CIPG with additional internal capability for education and training when the Center is not used for Sino-U.S. joint venture training programs delivered by ISU.

Relationships

CIPG was established 50 years ago by Mdm. Soon Qing Ling as the Foreign Languages Publishing and Distribution Administration, a Bureau within the Chinese Ministry of Culture. It is China's largest printer/publisher of literature, magazines, and cultural materials distributed world-wide in 50 different foreign languages. CIPG has publishing and distribution offices in London, Paris, New York, San Francisco, Tokyo, Cairo, Hong Kong, Macao, Lima, and in Tanzania. Key periodicals include *Beijing Review* and *China Today*. Publishing divisions include Foreign Languages Press, Panda Books, Chinese Literature Press, New World Press, Sinolingua, and many others.

Illinois State University has had a successful exchange program with CIPG for 18 years. This relationship has facilitated over 300 faculty from the

institution to study and travel in China and for a few to work as trainers/consultants in China. Equally important has been the opportunity for CIPG professional staff to participate in educational programs, attain Master's degrees from Illinois State University, and return to Beijing to undertake significant positions with the company and to contribute positively to the goals and future of CIPG.

Cooperating to create the ISU-CIPG Center for Corporate Training & Consulting in Beijing is a logical extension of an solid existing relationship. Both ISU and CIPG will benefit from increased access to professional development opportunities for their employees and will serve as model leaders in meeting the needs of Chinese and U.S. companies as they meet the challenges of world trade for the next century.

BENEFITS TO CHINA **INTERNATIONAL PUBLISHING GROUP**

Hosting the Center for Corporate Training and Consulting will provide CIPG with the following benefits:

- a world-class training facility with distance learning capability.
- CIPG staff and employees will have access to ISU courses for continuous improvement.
- access to ISU faculty expertise for CIPG projects.
- increased relationships with Sino-U.S. joint venture companies which may yield investment potential, increased commercial printing potential, and advertising in CIPG publications
- a source of income once center becomes self-sufficient.

Courses/Topics and Certification Programs

Illinois State University will provide courses and topics based on Motorola University in China course offerings and ISU capabilities. Research is presently being conducted with 135 Sino-U.S. joint venture firms in Beijing to determine their level of interest in these program offerings. Results of this extensive market study will provide direction to the seminar and course topics offered as the Center opens in early 1999.

IDENTIFICATION OF FACULTY EXPERTS

Faculty and trainers will be needed with expertise in the following areas to serve the needs of U.S.-Sino businesses in China:

- **Marketing and Sales**
 - Customer Service and Customer Satisfaction
 - Marketing Business Services
 - Marketing Products
 - Sales
 - Strategic Market Planning
- **Management and Quantitative Methods**
 - Human Resources Management
 - Benchmarking
 - Crisis Prevention for Managers
 - Management & Supervision of Employees
 - Global Management Perspectives
 - Team Building
 - Quality Programs
 - Quality Function Deployment
 - Project Management
 - Workplace Organization
 - Organizational Change
 - Problem Analysis and Decision Making
 - Statistics (Applied)
 - Negotiation Skills
 - Creativity in Management
 - Leadership
- **Finance & Law**
 - Ethical Practices in Business
 - Business Finance
- **Accounting**
 - Account Planning
 - Estimating for Managers
- **Business Education & Administrative Services**
 - Office Administration
 - Office Systems & Technology
 - Office Records Management
 - Business Problem Solving
 - Conducting Effective Meetings
 - Office Skills
 - Business Communication Tools
 - Time Management
- **Applied Computer Science**
 - Data Base Systems
 - Management Information Systems
 - Computer Applications
 - Internet & Intranet Applications/WWW/Email
 - Data Security Systems
 - Project Management Software
 - Software for Information Systems
- **Health Sciences**
 - Environmental Health and Safety
- **Industrial Technology**
 - Quality Control and Total Quality Systems/Programs
 - ISO 9000 Series
 - Quality Function Deployment

Benchmarking
 Production and Operations Management
 Agile Manufacturing
 Group Technology
 Materials Handling
 Team Building
 Manufacturing Systems & Processes
 Project Management
 Computer Integrated Manufacturing
 Robotics
 Control Systems
 Pneumatics
 Facilities Design
 Industrial Computer Systems
 Telecommunications
 Networking Systems
 Computer Applications: Microsoft Office and Desktop Publishing
 Train the Trainer
 On-The-Job-Training Programs
 Training Materials Development
 Assessment of Training Needs
 Evaluation of Training
 Instructional Delivery
 Design of Experiments
 Estimating for Managers

- **Family & Consumer Sciences**
 - Foods & Nutrition
 - Retail and Fashion Merchandising
- **Agriculture**
 - Agribusiness
- **Curriculum and Instruction**
 - Distance Learning
 - Instructional Delivery
 - Instructional Technology
- **Communications**
 - International and Intercultural Communications
 - Public Speaking
 - Problem Analysis and Decision Making
 - Conducting Meetings
 - Behavioral Interviewing
 - Presentation Skills
 - Public Relations
 - Negotiation Skills
 - Understanding People
- **Economics**
 - International Trade
 - Global Economics
- **English**
 - Technical Writing
 - Writing Tools
 - English as a Second Language

- **Foreign Languages**
 - Chinese language for the business environment
- **Psychology (Applied Psychology)**
 - Industrial/Organizational Psychology
 - Human Resources and Personnel Psychology
 - Worker Motivation & Attitude
 - Organizational Change
 - Understanding People

Motivating Faculty to Serve as Trainers

To encourage the widespread participation of faculty from throughout the institution in the project and enable the delivery of training in China, ISU will release faculty from teaching for one to two week periods during regular semesters with longer periods of delivery during break times. In addition, faculty and trainers will receive all travel expenses, lodging, support services for the preparation of seminar materials, and a stipend to supplement their regular salary.

Response has been positive on all fronts related to the project, its goals, and timeline. It is anticipated that as the Center progresses, additional faculty and trainers' will be needed from other institutions in the U.S.A. This anticipation is based on the assumption that popular training topics may need to be offered so frequently that more than one or two people will be required to provide the program. Teams of faculty will prepare the materials so that anyone can deliver the program given reasonable expertise and familiarity with the topics.

Exciting Times Ahead

The proposed ISU-CIPG Center for Corporate Training & Consulting is in every way an innovative partnership. It builds upon an already solid relationship between two well-respected organizations: Illinois State University and CIPG. The ISU-CIPG Center for Corporate Training & Consulting will serve a unique niche in the ever growing need by Sino-U.S. joint venture firms in China for corporate training and technology assessments. It enables a major midwestern U.S. university to establish itself as a leader in providing business and corporate services in Asia. The ISU-CIPG Center will help meet the economic development needs of a broad range of companies with corporate headquarters and divisions in Illinois and throughout the midwest. It will also provide a major corporate out-reach initiative which will serve to position the university well as a liaison to key U.S. corporations conducting business in China. As host for the Center, CIPG will show leadership in assisting Sino-U.S. joint venture compa-

nies to improve their economic viability and, thus, contribute to the improvement of former government-dependent companies including the divisions of CIPG.



Jane Liedtke
professor

Dr. Jane Liedtke is a Professor of Industrial Technology at Illinois State University. She also serves as Director for the Center for Corporate Training & Consulting/Beijing.

Teaching Students About Color Management

Dr. Jerry Waite, Assistant Professor
Department of Industrial Technology
University of Houston

Several years ago, color theory, color separation, and color correction were considered high-level skills that were taught in advanced courses in technically-oriented colleges and universities. However, technical advisory committees are increasingly pointing out that color theory, separation, and correction are indeed basic skills in today's printing and publishing industry. Snyder (1997) did an extensive industry analysis and concluded that color theory must be considered a "fundamental as opposed to an advanced course."

The advent of personal computing and desktop publishing has made the task of teaching color theory, color separation, and color correction both easier and more difficult. Teaching these topics is easier today than in the past because of the relatively low cost of personal computer workstations and powerful software such as Adobe Photoshop—it is certainly easier for schools to provide students with desktop computers than drum scanners! However, the variability inherent in computer monitors, desktop scanners, and color output devices has made the teaching of color separation and correction more difficult than it was years ago. The original mantra of desktop publishing—"what you see is what you get"—has proven to be an absolute falsehood when it comes to judging on-screen color. Due to numerous print production factors, the real mantra today is "what you see is not that you get." Graphic Arts teachers have had to teach their students to disregard what they see on the screen because the monitor itself does not display accurate color and because ink characteristics, dot gain and paper color, coating, and absorbency will all change the color of the printed job. Instead, students must be taught to perform color correction "by the numbers" (Margulis, 1995). From the student's perspective, it must be very difficult to look at a brilliant green image on the screen and imagine what it will look like based upon the CMYK values that Photoshop will use to reproduce it. Color correction would be much easier if the on-screen image were reliable.

Impediments to On-Screen Image Reliability

There are two major impediments that must be overcome if the color of an on-screen image is to be trusted. First, the monitor itself must be adjusted so that its white point accurately simulates white paper. Unfortunately, the default white color produced by color monitors—i.e. when their red, green, and blue phosphors are all completely energized—is a blue-white rather than the brownish-white associated with most white printing papers.

The second impediment to reliable on-screen color is the varying color gamuts of different color devices. A gamut is the range of visible or reproducible colors of a viewer or device (X-Rite, 1996). By definition, the human eye (as determined by a "standard" viewer) can discern the widest gamut of color. The gamuts of all color reproduction methods are smaller than the human eye's gamut. In addition, the gamuts of different color reproduction processes vary. For example, color film can record more colors than a computer monitor can display, but fewer than the eye can distinguish. CMYK printing has a different gamut than RGB monitors—monitors can display some colors that CMYK cannot reproduce, and CMYK can print a few colors that cannot be displayed on a monitor. Because color gamuts vary, it is important to understand that no reproduction process can provide the same number of colors that the human eye can see. Therefore, all reproductions are less colorful than reality. Figure 1 provides a visual representation of some gamuts.

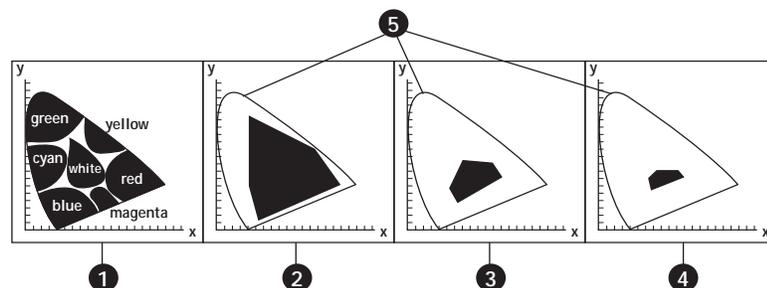


Figure 1. Gamuts of selected reproduction processes: 1. Visible gamut of colors 2. Color gamut that can be reproduced by color film 3. Color gamut that can be reproduced using CMYK inks with offset lithography 4. Color gamut that can be reproduced using newsprint 5. Boundaries of visible gamut

The difference in CMYK and RGB gamuts is the major reason that on-screen color is not reliable. Unfortunately, too many colors—especially bright greens, blues, purples, and oranges—look beautiful on the screen but appear muddy when printed. In order for an on-screen image to reliably predict the press performance of an image, many brilliant RGB colors must be artificially muted (remapped) so that they appear within the gamut of CMYK.

Color Management Systems

Both impediments to reliable on-screen color can now be solved by using a color management system (CMS). A CMS is software that converts colors from one gamut to another to compensate for differences between input, display, and output devices (Kieran, 1997). Macintosh computers provide a built-in system-based CMS called ColorSync. Windows 95 users, as of this writing, must purchase a separate CMS, such as Image Color Matching (X-Rite, 1996). However, future releases of Windows will probably contain a built-in CMS.

To be effective, color management systems must know the color gamuts of the devices used in a given production center, including scanners, monitors, color proofers, and color printers (including printing presses). The information regarding a specific device's color gamut is saved in a file called a profile. The CMS must have a profile for each device that will be used in the production of a particular image.

Profiles can be obtained in two ways: generic and custom. Generic profiles are based on the average of several identical devices. For example, profiles are created by manufacturers when random devices of the same brand and model are tested. Generic profiles are generally included on a disk when you purchase a device. Custom profiles, on the other hand, include the color characteristics of a specific device. If possible, it is best to use custom profiles rather than generic profiles because a generic profile does not take into account the peculiarities of individual devices (Oppman and Waite, 1997). Custom profiles can be made in-house for each specific device used in a printing firm or service bureau. Alternatively, many publications printers now provide custom profiles of their specific equipment. In some cases, printers upload the profiles to web pages so that they may be downloaded by clients.

Creating Calibrated Profiles with Colortron

To fully understand the power of a color management system, students need to learn how to create custom profiles. Thankfully, graphic arts instructors can teach their students how to create profiles using a relatively inexpensive package called the Colortron Color System. The Colortron Color System as described in this article costs less than \$1,700 and works with both Macintosh and Windows computers—software for both platforms comes in the package. Unfortunately, as of this writing, the Colortron cannot perform monitor calibration for Windows computers because Windows lacks a system-based color management system.

The Colortron system is composed of four major components: a hand-held 32-band spectrophotometer, Colortron Calibrator software, ColorShop software, and Profile Factory software. The spectrophotometer is the measuring device that works with all three software packages. The Colortron Calibrator is used to create monitor profiles on Macintosh computers and to simulate varying white point color temperatures. ColorShop is a program that is used, in conjunction with the spectrophotometer, to capture colors from objects, compare colors to one another, measure density, and many other useful tasks. Profile Factory is used to build profiles of color scanners and color output devices. To create custom

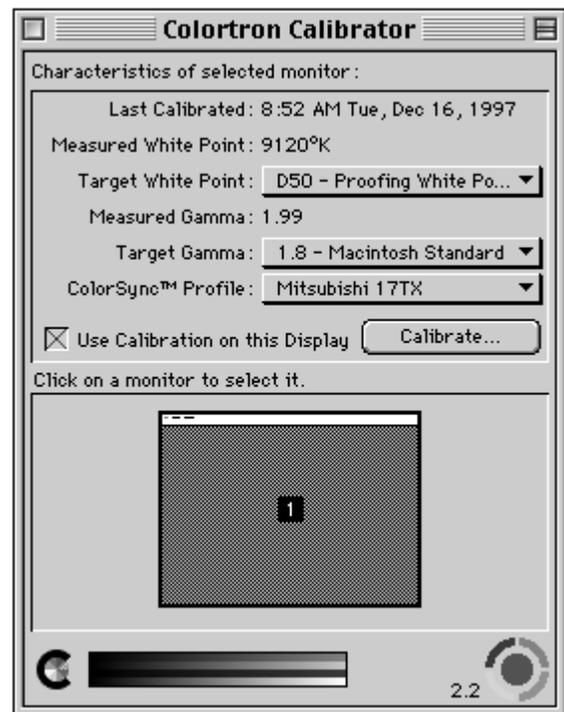


Figure 2.



Figure 3.

profiles, a user must have the spectrophotometer, Colortron Calibrator software, Profile Factory software, and a color scanner.

Profiling Monitors with Colortron

Before a monitor is profiled, it's smart to reduce as many variables from the environment as possible. Room glare or natural light from a window or skylight can affect the appearance of calibrated monitors. In the printing industry, a glare hood made of black mat board should be affixed to the monitor. Room lighting should be made consistent—lighting should be either always on at a consistent level of intensity or always off. Color experts recommend diffuse fluorescent lighting with complete spectrum (5,000°K) tubes.

Apple suggests that monitors be calibrated on a regular basis. Once each month is probably adequate for school-lab computers. Begin the process by installing ColorShop on the Macintosh. Turn the computer off, then connect the spectrophotometer to the proper port. Restart the computer, then, from the Apple Menu, choose Control Panels. Select Colortron Calibrator to display the Colortron Calibrator dialog box. Figure 2 illustrates the Colortron Calibrator for a Mitsubishi 17TX monitor that was last calibrated on December 16, 1997. Note its measured white point is 9,120°K, substantially higher than the 5,000°K white point used by most printers and publishers in the United States. The Target White Point pop-up menu is used to alter the monitor's white point to match one of eight different lighting conditions, including D50 (5,000°K) and D65 (6,500°K). D50 is the

appropriate choice in the United States, while D65 is generally used in Europe and Asia.

To calibrate an uncalibrated monitor, or to recalibrate a monitor, click the Calibrate button and follow the on-screen instructions. At a given point during the process, the spectrophotometer must be affixed to the face of the monitor as shown in Figure 3. Once the spectrophotometer has been installed, the Colortron Calibrator software displays a range of colors on the screen. The spectrophotometer measures each of those colors and provides the measurements to the software. When the measurements have been completed, the software creates a profile that must be given a name and saved in the ColorSync Profiles folder. (System 8 places the ColorSync Profiles folder in the Preferences folder within the System folder.) Once the profile is saved, the Colortron Calibrator dialog box should be closed. The Colortron Calibrator dialog box can be used at any time to recalibrate the monitor or to change the Target White Point. (Note: Once a monitor is calibrated and its profile saved, the Gamma Control Panel that comes with Photoshop should not be used. Use the Extensions Manager to disable it).

The ColorSync System Profile dialog box can be used to select a specific monitor profile (Figure 4). From the Apple Menu, choose Control Panels, then select ColorSync System Profile. If the monitor has already been calibrated with the Colortron Calibrator, the name of the appropriate profile is indicated on the left side of the dialog box. To choose another profile, click Set Profile, navigate to the ColorSync Profiles folder, and choose the appropriate profile.

Profiling a Scanner

Once the monitor is calibrated and profiled, the second step in color management is to profile the color gamut of the scanner. This process involves scanning a target and using the spectrophotometer to physically measure a graybar (gray scale) and a colorbar. The

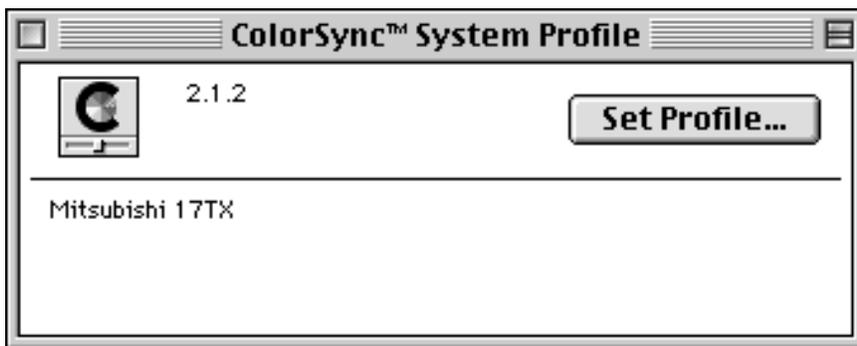


Figure 4.



Figure 5.

Colortron Profile Factory software then compares the colors scanned by the scanner to the measured colors of the colorbar and graybar and creates a profile that takes into account the characteristics of the scanner.

Before a scanner profile can be created, the Profile Factory Reflective Scanner Profile Target must be scanned using the appropriate scanner. The target consists of two parts: a colorbar consisting of eight color patches and a separate 21-step graybar. The graybar must be temporarily taped to the colorbar before scanning (Figure 5). The scanner software must be set to 100 pixels per inch (ppi) resolution at 100%. In addition, any automatic correction settings must be disabled. The scanned target must be saved as an uncompressed TIFF file and placed in the Scanned Targets folder within the Profile Factory folder.

To profile a scanner, launch Profile Factory. The Profile Factory Control dialog box will appear (Figure 6). Use the Device Type pop-up menu to choose RGB scanner, then click Create Profile. The Create Profile dialog box appears (Figure 7). Click the Measured Graybar pop-up menu and choose Measure. Then, measure each step of the 21-step graybar using the spectrophotometer and save the measurements in the Graybar Palettes folder within the Profile Factory folder. After the graybar has been measured, click the Measured Colorbar pop-up menu and choose Measure. Then, measure each of the eight color patches on the color target. Save the measurements in Colorbar Palettes folder within the Profile Factory folder.

Once both the Graybar and Colorbar have been measured, click the Scanned Image pop-up menu and choose Open. Navigate to the Scanned Targets folder and open the TIFF file of the Profile Factory Reflective Scanner Profile Target. A representation of the four



Figure 6.

corners of the scanned target will appear in the Image Alignment window (Figure 8). The mouse is then used to drag the colored alignment guide to the actual corner of the scanned image in each quadrant. After the image is properly aligned, click Build Profile. After the profile has been created, a Save As dialog box will appear. Navigate to the ColorSync Profiles folder and save the profile with a descriptive name.

A separate scanner profile should be created for each scanner that will be used in the lab or prepress area. If scanned images are obtained from outside sources—i.e. service bureaus, printers, other labs, and so on—profiles of those scanners should also be obtained and placed in the ColorSync Profiles folder. In essence, a scanner profile should be available for every scanned image used in a facility.

Profiling an Output Device

The final step necessary to prepare a color management system is the preparation of output device profiles. To create an output device profile, an Output Profile Target must be printed on each color output device to be profiled. Several different types of output devices may be profiled (see Figure 9).

The Output Profile Target may be printed from within Profile Factory or from within another program such as Photoshop or QuarkXPress. In fact, it is recommended that the target be printed from within QuarkXPress if that is the program generally used to output finished documents (Light Source, 1996). In addition, if film

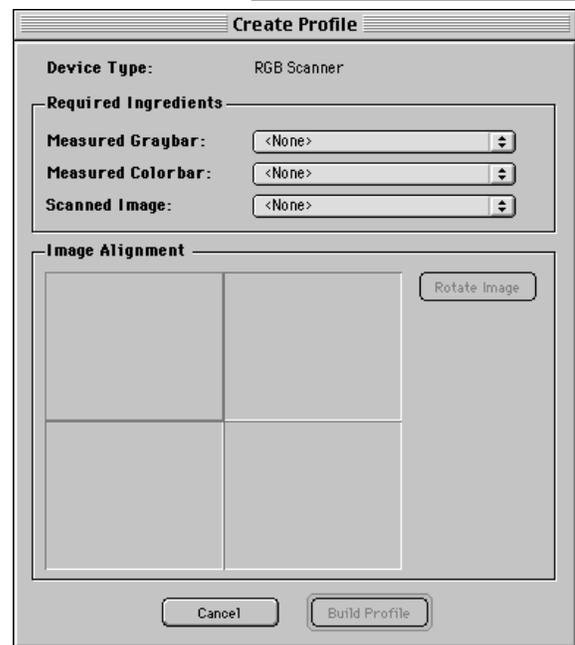


Figure 7.

separations are required, the target may need to be output from a page layout program or Photoshop so that a "print separations" option is available. To print the target from a program other than Profile Factory, open or place the TIFF file named "Output Target CMYK" using the applicable program. The file can be found in the Printable Images Folder within the Profile Factory folder.

To print the Output Profile Target from within Profile Factory, click the Device Type pop-up menu on the Profile Factory Control dialog box and choose a type of output device (Figure 9). Then, click the Print Chart Button and use the subsequent Page Setup and Print dialog boxes to print the Target.

If the output device is a color printer, the machine will produce a completed color Output Profile Target similar to the black-and-white illustration in Figure 10. If separations are output, those separations must be imaged using a printing press or a proofing system such as Imation Matchprint. In any case, the completed target must be a full color image that can be placed on the bed of the scanner.

Once the Output Profile Target has been printed, temporarily tape the 21-step graybar to the area reserved for it on the lower left side of the target (see Figure 10), then scan the target. The scanner software must be set to 100 pixels per inch (ppi) resolution at 100%. In addition, any automatic correction settings must be disabled. The scanned target must be saved as an uncompressed TIFF and placed in the Scanned Targets folder within the Profile Factory folder.

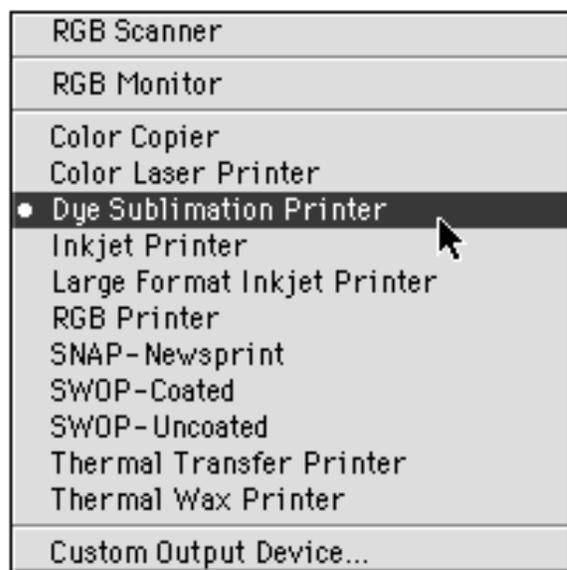


Figure 9.

To create an output device profile, choose the Device Type in the Profile Factory Control dialog box (see Figures 6 and 9), then click Create Profile. When the Create Profile dialog box appears, use the Measured Graybar and Measured Colorbar pop-up menus to specify the appropriate files. Then, click the

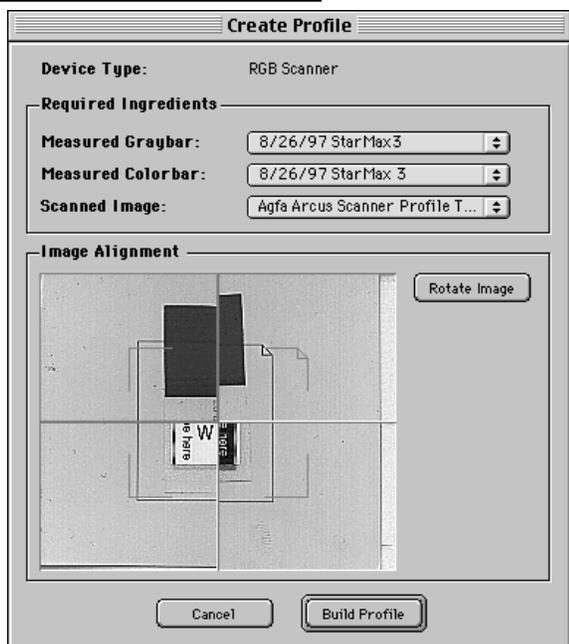


Figure 8.

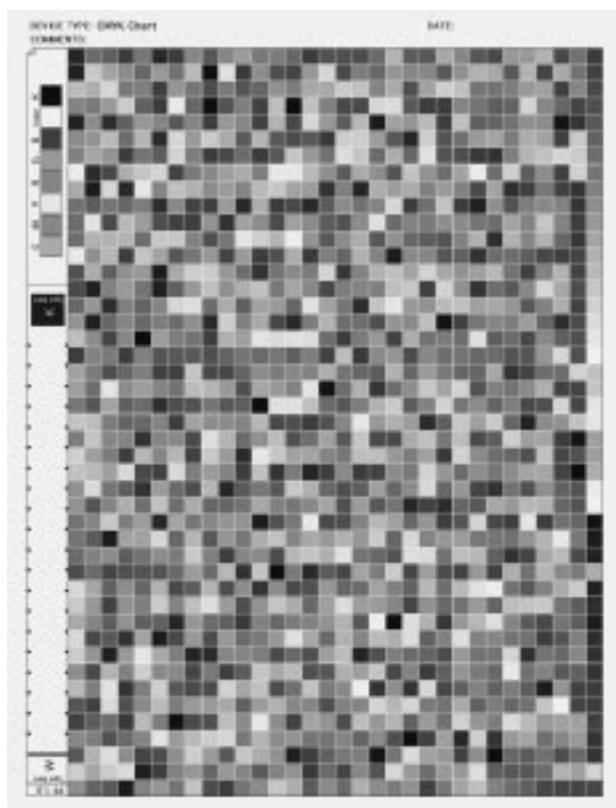


Figure 10.

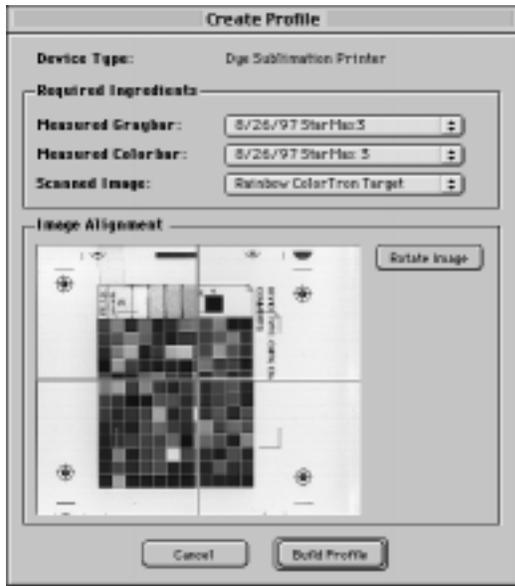


Figure 11.

Scanned Image pop-up menu and select the Output Profile Target TIFF file that was scanned from the printed output of the device to be profiled (Figure 11). A representation of the corners of the scanned target will appear in the Image Alignment area. Use the mouse to drag the colored alignment guides to the actual corners of the scanned image. After the image is properly aligned, click Build Profile. Wait until the Generating Profile progress bar indicates that the profile is complete, then save the profile with a descriptive name in the ColorSync Profiles folder.

Scanning Images to be Used With Scanner Profiles

Whenever images are scanned, it is important that as many variables as possible are eliminated from the process. Most variables are automatically eliminated if the scanner is set exactly the same way it was when it was profiled. In particular, be sure that any automatic correction settings are disabled before an image is scanned. In addition, it is recommended that the 21-step graybar be scanned along the side of every image—be sure that the graybar is not cropped out of the scan (Figure 12). Scanning the graybar with the original ensures that the white point and black point are set exactly the same way as they were when the scanner was profiled.

To take full advantage of the power of profiles, all scans should be done in RGB mode—CMYK mode should not be used—and saved as uncompressed TIFF files. The CMYK mode should not be used during scanning because the output device profile will automati-

cally convert the RGB file into the color gamut of the chosen output device. If the file is converted to CMYK too early in the process, the image must be converted to RGB before the output profile can be applied. Each conversion from one color mode to another can result in loss of quality. Eventually, profiles will be able to work with images saved in formats other than TIFF, including PICT, EPS, GIF, and JPEG. However, as of this writing there are few application programs that work well with formats other than TIFF.

It is important to understand that the objective of scanner profiles is to reproduce images using colors that are as close as possible to those in the original. If the color balance in the original is skewed, the color balance in the scan will also be skewed. If the intention of the reproduction is to match the original, then such a reproduction will be acceptable. If, however, the intention is to match the colors in the original scene, color-balance correction will be necessary.

Using Profiles With Adobe Photoshop

Profiles can be applied in page-layout, vector-graphic, or bit-mapped graphic programs. However, for the purposes of this article, the use of profiles with Photoshop will be emphasized.

There are three profiles in use when an image is manipulated in Photoshop—Monitor, Input Device, and Output Device. The Monitor profile is applied to the entire Macintosh System by the ColorTron Calibrator dialog box or the ColorSync dialog box. The Input and Output Device profiles are applied to a given image by Photoshop when the image is opened, while it is open, or as it is saved. ColorSync uses all three of these profiles to create a “common ground” of colors that exist in the gamuts of the scanner, monitor, and output device. When all three profiles are applied



Figure 12.

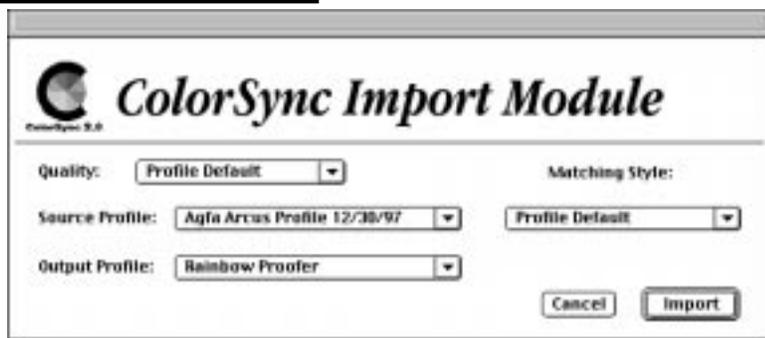


Figure 13.

to an image, only those colors that all three gamuts share are displayed on the screen (X-Rite, 1996). Any colors that exist in one profile but not another are mapped into the common ground. Mapping colors into the common ground can be done in two ways: clipping and compression. Clipped colors are remapped to their nearest in-gamut equivalent. Clipping does not change most of the colors in the image. However, the relationship between adjacent unchanged in-gamut colors and remapped out-of-gamut colors may be unsightly. If a compression scheme is used, all colors (both those in-gamut and those out-of-gamut) are remapped to colors within the common ground. Because compression remaps all colors in an image, the overall lightness or darkness of the image may change. However, the relationship between all the colors in the image remains the same. Therefore, no unsightly juxtaposition of in-gamut and clipped colors occurs (Light Source, 1996).

To apply profiles to images in Photoshop, three ColorSync 2.0 Plug-ins—ColorSync Acquire, ColorSync Export, and ColorSync Filter—must be installed in the Import/Export folder in the Plug-Ins folder within the Adobe Photoshop folder. These Plug-ins are available free of charge at Apple's Web Site (<http://swupdates.info.apple.com>). The Acquire Plug-in allows profiles to be applied to an image as it is opened. The Export Plug-in applies filters as an image is saved. The Filter Plug-in applies profiles to an open image. No matter which Plug-in is used, the original RGB scan file should never be changed then saved—always work on a copy of the original file or use Save As after changes have been made to the image. In this way, the original RGB file will be available in case it is necessary to apply a different profile to the image.

The choice of which Plug-in to use really depends on the way the user wishes to perform color correction on an image. If the user prefers to work in the RGB mode, the Export Plug-in is best because the image remains in RGB until it

is saved—the CMYK conversion is done at that time. If the user prefers to perform color correction in the CMYK mode, it is best to use the Import Plug-in because the image will be separated into CMYK as it is opened. The Filter Plug-in is not recommended because it physically alters the image as soon as it is applied. If the file is inadvertently saved without changing its name, the original RGB file will be lost.

To apply profiles as an image is opened in Photoshop, click the File menu, choose Import, then select TIFF with ColorSync Profile. Navigate to the file you wish to open and click Open. The Color Sync Import Module appears (Figure 13). Set the Source Profile to the device on which the image was originally created. If the image was scanned, choose the scanner's profile. If, however, the image was created or manipulated on a given monitor (so that the on-screen image is the desired appearance), the Source Profile should be the monitor's profile. Click the Output Profile pop-up menu and choose the profile of the output device. The Quality pop-up menu should be set to Profile Default. In most cases, the Matching Style pop-up menu should be set to Profile Default or Perceptual. (The Perceptual Style uses the compression method of remapping.)

To apply profiles to an image when it is saved in Photoshop, click the File menu, choose Export, then select TIFF with ColorSync Profile (Figure 14). Choose one of the options in the Processing Selection. "Embed profile within image" simply copies the source profile into the header of the TIFF file so that it can be read by another ColorSync-aware program. "Match image on an output device" converts the image from the gamut of the source device to the gamut of the output device. This



Figure 14.

option forces the ColorSync color matching to become part of the image at this point. It should only be used when the output device is known and if a profile for the output device is available. "Proof matched image on a proofing device" converts the image from the gamut of the source device to the gamut of the output device then to the gamut of the proofing device (Light Source, 1997). Once the Processing Selection option has been chosen, choose the appropriate Source, Output, and Proofer profiles. Quality should be set to Profile Default, while Matching Style should be Profile Default or Perceptual. Click Export TIFF to save the file.

Conclusion

Even though color theory, separation, and correction have become basic skills in the printing and publishing industries, graphic arts instructors have had a difficult time teaching these skills because the image on computer monitors has not been even remotely the same as the final printed image. Color Management Systems, such as ColorSync, are making it easier for students to learn how to manipulate color because such systems cause the image on the screen to become reliable predictors of press performance. To fully exploit the power of Color Management Systems, students need to learn to create the device profiles that Color Management Systems use to standardize color. The combination of Photoshop in conjunction with a relatively inexpensive package—the Colortron Color System—makes it possible for graphic arts instructors with tight budgets to teach the basic skills of color management.

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Shingo's Strategies for Set-up Reduction

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Every printed product, regardless of what is being printed, has to go through a series of transformation processes to arrive at a printed piece that meets customer expectations. Research has shown that, in general, 95% of the activities related to a given process do not add value to the product (Productivity, 1992). Non value-added activities include defects in raw materials, waiting, rework and inspection, equipment down-time, storage, and materials handling and transportation.

For years companies have devoted resources to increasing output and reducing the amount of equipment downtime encountered during scheduled run hours. Little attention has been paid to the amount of time taken to complete necessary set-up activities that occur between jobs. Machinery downtime due to long set-ups is cited as one of the major losses in American industry (Productivity, 1992). Traditionally, a consistent methodology has not been applied to study set-up reduction and adjustment. This paper explains Shingo's strategies for set-up reduction, the reasoning behind them, and the methodology for reducing set-up time.

Myths About Set-up

For many years, managers and workers in the printing industry assumed that a high level of knowledge and skill, acquired only through lots of practice and long experience, is required for effective and efficient equipment set-up. Some estimators and production planners assume that large-lot production can diminish the effect of long set-up times on machines, resulting in increased efficiency and production capacity. These myths are based on the assumption that set-up time cannot be significantly reduced. In order to achieve success in reducing set-up times, these assumptions must be changed.

Benefits of Set-up Reduction

There are numerous benefits that can result from reducing equipment set-up times. According to Hay (1989), reduction in set-up time results in shorter manufacturing lead times, a smooth and repeatable production flow, and eliminates waste activities. Set-up reduction is the first step in realizing the benefits of continuous process improvement. Improved customer response time and more capacity on bottlenecked machinery are additional advantages associated with set-up reduction. Shingo's Single Minute Exchange of Die (SMED) technique has become a proven way to improve efficiency of current operations in printing organizations (Robbins, 1993).

Development of the SMED Technique

A scientific approach for reducing set-up times was developed by Dr. Shingo Shingo in Japan in the 1950s. Dr. Shingo was president of Japan's Institute of Management Improvement and distinguished himself as one of the world's leading experts on improving the manufacturing process. The development of the SMED concept took many years, and came about as the culmination of Dr. Shingo's insight into the practical and theoretical aspect of set-up improvement. Dr. Shingo was one of the key creators of many features of the revolutionary Just-In-Time (JIT) methods. Toyota used the SMED technique to significantly reduce the set-up time on a 1,000 ton press from four hours to 90 minutes (Shingo, 1985).

Four Step SMED Methodology

The printing industry is similar to other industries in that raw materials must be purchased and passed through numerous operational tasks to become finished products. In traditional printing, operational tasks can be classified as internal and external. Tasks that are performed when the machine is stopped are called internal, and tasks that can be performed while the machine is in operation are called external (Shingo, 1985). Oftentimes these tasks are confused —

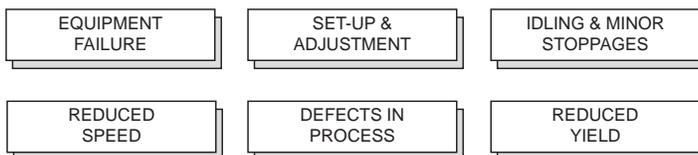


Figure 1: Losses in Equipment Operation

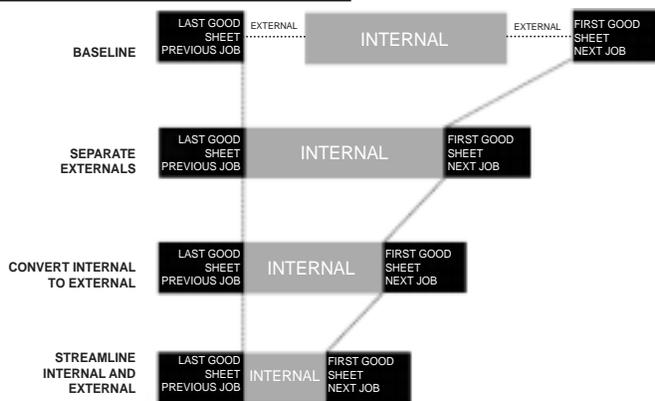


Figure 2: Set-up Reduction — 4-step approach

what can be done externally is often done as an internal set-up. As a result, machines remain idle. The philosophy of the SMED technique is to deal with these two types of set-up tasks to reduce inefficiencies in the set-up process. Figure 2 describes the step-by-step procedure for applying the SMED technique.

Implementation of SMED

The SMED technique has been implemented successfully in various manufacturing industries, such as automotive, plastics, washing machines, and printing. According to Hayes (1989), manufacturing organiza-

tions can reduce set-up time, by 75% or more with little or no cost and without capital expenditure, by implementing the SMED technique successfully. In the printing industry, the application of the SMED technique has been effective especially in the pressroom area, which is one of the highest cost centers. According to Lord, (1994), after the implementation of the SMED technique on a 55" 4-color offset press, the average setup times were reduced 85% from 297 minutes to 42 minutes. In addition, the standard deviation dropped from 108 minutes to 22 minutes. Figure 3 is a process flow diagram used by the cross departmental team

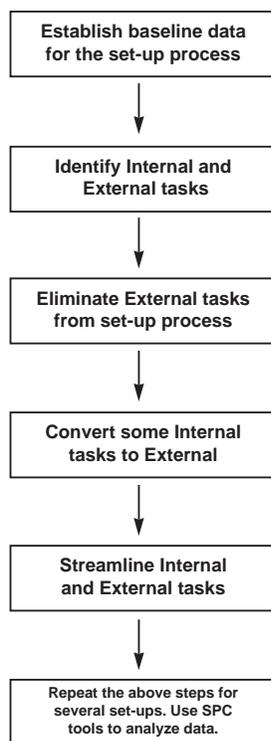


Figure 3: Process flow diagram

charged with the task of reducing set-up times on the 55" four color press.

The team members had exposure to Deming's quality philosophy and were trained in the use of statistical control methods and problem-solving. Figure 4, a Pareto diagram, is one of the Statistical Process Control (SPC) tools used for analyzing set-up tasks for 19 four-color makereadies.

Implications For Graphic Arts Educators

The study of activities and times taken to complete machinery set-up steps that occur between jobs is vital for achieving consistency and quality improvement in production. Shingo's SMED technique has become a powerful tool for reducing set-up times in the printing industry. Incorporation of Shingo's strategies for set-up reduction into graphic arts technology and management curriculums will broaden students' knowledge of productivity improvement techniques and current industrial practices. It will enable them to make significant contributions towards productivity improvements in the printing industry.

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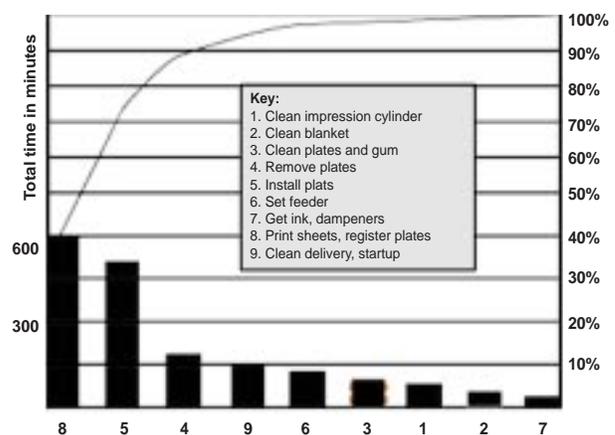


Figure 4: Pareto diagram

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Instruction-On-Demand— The New Era of Computerized Instruction

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Introduction

The use of computers in the teaching process started around 1960. Many computer-assisted instruction projects have been conducted since then. Since the late 1970s, rapid advances in desktop computer technology made computers smaller, less expensive, and more powerful. The advancement of telecommunications technology also provides an ideal channel for information delivery. Presently, the nature of computerized instruction has shifted from limited and conceptual subject content to a media-integrated, needs-fitted, and customized application on-line via the Internet using the World Wide Web (Cotton, 1997; Davis, 1997; Fleischman, 1996; Lynch, 1997; McConville, 1996; Pollock, 1997; Wiburg, 1997).

The Concept of Instruction-On-Demand

Due to social and demographic changes—including the desire for retraining after a few years on the job, the need to work while attending school, and the declining teenage population—institutions have to develop new programs and services to attract nontraditional students in order to maintain enrollments (Cotton, 1997; Fleischman, 1996). At the same time, many students will choose institutions that offer convenient programs fitted to their aspirations and specific needs (Smyth, 1995; Wiburg, 1997). These trends are pushing higher education toward a new model of instructional delivery with specialized programming that allows students to obtain education when and where they desire. Such technology provides students with the option to experience lessons multiple times while avoiding repetition of content already mastered. This instruction is time- and place-independent.

Instruction-on-demand is a new form of instruction. It meets students' needs by sending interactive courseware digitally across the country to be taught on-the-spot where the student needs it—on-demand—at any time. Currently, on-line technology is available to anyone with a personal computer and a connection to telecommunication networks, communication satellites, the Internet, or commercial on-line services. Such

services allow students to communicate, download information, and transfer files interactively.

Newly-developed programming languages, such as Java and VRML, also helped to improve the quality and efficiency of courseware transmission. Java is a cross-platform programming language that is used to create small applications, called applets. These applets are programs that can be attached to a Web page using a normal HTML tag and are represented on the page by some image or symbol. When a user clicks on the symbol, the symbol downloads the applet over the network and runs it locally (Holliday, 1997; Majchrzak, 1996). VRML is a 3D scene description language and file format for transmitting 3D images over the Internet. VRML has six functions, or nodes, for describing 3D scenes. Material nodes describe bindings and text; shape nodes determine 3D primitives, point sets, and faces; transformation nodes control an object's size, position and rotation; camera nodes set the perspective views; group nodes organize objects into manageable chunks; and lighting nodes illuminate the scene and its objects. Both Java and VRML are powerful vehicles for transmitting almost any type of instruction over the Internet.

The combination of the World Wide Web delivery and instruction-on-demand technologies can provide faculty with the ability to develop customized and targeted courseware. It can definitely lower course development and deployment costs, as well as increase instructional effectiveness.

The Instruction-On-Demand Model

Technologies provide a highly interactive teaching-learning environment. Presently, instruction-on-demand is based on state-of-the-art information technology. It provides a high level of interaction between faculty and students, students with other students, and students with electronic resources such as interactive instructional resources, Web-related data bases, and digital journals and books. The following model is a system approach that is based on current technologies and the requirements for successful instruction.

During the process of instruction-on-demand, faculty are in charge of the course content, course management,

and course resources with the assistance of a development team that consists of computer system engineers and graphic designers.

AUTHORING

Courseware design focuses on determining the goals and expected outcomes of educational experiences and then matching those goals to the desired instructional strategies and to supported media. The expected content includes a course syllabus, multimedia instructional content, and assistants. The skill needs for course content authoring are:

- using a browser to create and edit the Web page.
- converting Microsoft Office documents to HTML.
- using image-editing software for image editing and converting images to GIF and to JPEG.
- using multimedia authoring software to develop instruction modules.
- using Java applets for course content.

MANAGEMENT

An instructor needs to verify that a student has taken a course and record results of on-line tests and other activities such as projects, presentations, and papers. A server-based course management system is necessary to oversee the Internet deployment of courseware, control the access to courses through the Internet, manage test results, and monitor students' activities and progress.

WEB-RELATED DATABASE

Software development has allowed most database-driven applications to be available through a Web interface. This approach has many advantages. Students can use a familiar interface to interact with multiple applications—applications that run

cross-platform and are time-and-place independent. The dependency on in-person contact with an instructor is reduced. A complete instruction-on-demand Web-related database should consist of a digital library, interactive instructional resources, and real-life practitioners and experts.

Courseware should provide support for native Internet standards and applications based upon HTML and Java. Faculty can develop these Web instruction applications for Internet delivery as well as LAN delivery.

Strategies for Providing Graphic Communications Instruction-On-Demand

In recent years, the graphic communications industry has seen growth in the use of high and emerging technologies, such as computers, networks, lasers, digital imaging, and similar technological advancements, for its production processes (Cole, 1997; Delmontagne, 1998; Webb, 1998; Wilson, 1998). Sometimes, the rapid growth in equipment sophistication has made it very difficult to keep up to date with equipment capabilities and operating procedures. The pace of change in graphic communications technology continues at a rapid speed. Current employees' skills become outdated quickly. Job-seekers' skills often fall far short of optimum. These facts make instruction-on-demand with hands-on course content critical for current graphic communications students. The following strategies are very effective when conducting graphic communications instruction-on-demand.

MEDIA INTEGRATION

Media integration is the blending of various media, such as telephone, fax, computer, and television, into one appliance that allow people to interact using combinations of text, audio, video, and animation in real time or delayed. It allows students to interact with pre-produced text, audio, animation, and video, as well as interact with the instructor or other students using the Internet. This branching strategy, which allows students to determine the instructional sequence based on the information they desire, will increase the efficiency of hands-on training.

INDIVIDUALIZED COURSEWARE

Individualized custom-design courseware will help fulfill students' needs. It is especially

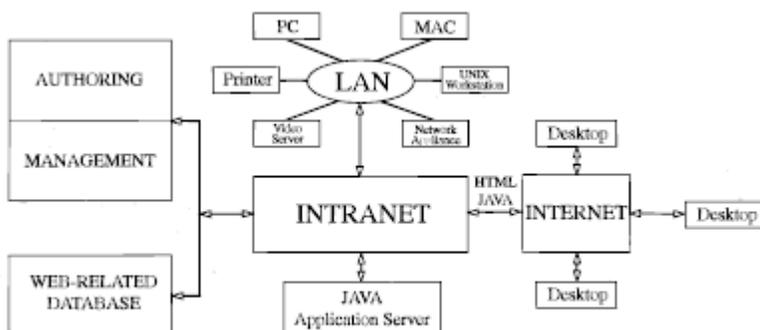


Figure 1: Instruction-On-Demand Model

important for the instruction of emerging technologies. Newly-developed courseware authoring software usually provides an object-oriented environment for developing Windows applications. It improves the faculty's capability for developing individualized custom-designed courseware.

REMOTE HANDS-ON TRAINING SITES

A remote hands-on training site is necessary for some highly complex graphic communications production processes training. A well-equipped graphic communications lab at a community college, university, production plant, or dealer's showroom could be utilized as a remote training site, dependent on availability.

Media integration, individualized courseware, and remote hands-on training sites are effective strategies for hands-on instruction-on-demand. The key determining factors the choice of strategies tend to be who the intended students are, where the students are located, and the available resources.

Conclusion

Instruction-on-demand technologies can be effective and powerful, but these technologies are not suited for all institutions and students. Cautious research is required to determine whether the technology should be used, what technology should be used, and what hardware, software, and courseware can best meet the student's needs. The instruction-on-demand model is a system approach that is based on current technologies and the requirements for successful instruction. Cautious research and appropriate decision-making will make instruction-on-demand an effective tool that gears instruction to student's needs and achieves the instruction objectives efficiently.

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The Technology of Book Production

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Editor's note: Chimaeze Njaka teaches in Nigeria where technology many of us take for granted is not available.

INTRODUCTION

Every year, millions of printed materials such as books, magazines, newspapers, and journals, among others, are produced for our use. Quite often, these printed materials are consulted daily by our students, teachers, researchers, and other professionals. They are consulted for purposes of education, information, entertainment, and for general knowledge. People who consult these materials may be ignorant of how they are produced and they may, in fact, care less about what is involved.

Only those who have prior knowledge, or have in one way or the other been exposed to printing and publishing, can appreciate the production process involved. An attempt will be made in this paper to acquaint the reader with the production processes involved in book production.

What is a Book?

In the ordinary sense of the word, a book is a long written or printed literary composition on paper leaves, perfectly arranged and bound together with a cover into a volume. A book, according to UNESCO, is a "non periodical literature publication containing 49 or more pages not counting the cover." But, Lehmann-Haupt (1968) indicated that the definition of a book depends on whether one is interested in the physical or in the functional characteristics of a book. If one is interested in the physical characteristics, a book is an assembly of leaves held together along one of the four edges and protected on the front and back with a cover of more durable material. In this very loose sense, he posited, not only a novel or a Bible, but also a cheque book, ledger, or notebook, can be called a book.

If, on the other hand, one is interested in functional characteristics, a book can be described as a more or less coherent body of graphic communication assembled into one of several units for the purpose of systematic presentation and preservation of lastingly valuable material. According to Lehmann-Haupt, it is this element of preservation—this retention of experience, observations,

and creative expressions of lasting value—that distinguishes a book from other more transitory communication processes. A book may also be described as a set of printed sheets bound together in one or more volumes.

Parts of a Book

A book consists of leaves of paper which are perfectly arranged and bound together at one edge with a protective cover. This protective cover could be hard-cover or paperback—in other words, soft cover. Behind this protective cover are the three main sections of a book: the preliminary section, the main text, and the reference section or back matter. A very important part of the preliminary section is the title page. Behind the title page, according to Ike (1996) are "the name and address of the publisher, the publishing history of the book, the reprints and editions, the International Standard Book Number (ISBN), the copyright owner ©, and the date the book was first published, the publication date, and the name of the printer."

Other important parts of the preliminary section are the foreword, the preface, the dedication, and acknowledgement pages. The preface usually contains a preliminary essay by the author explaining the intention of the book and the purposes to be served. The foreword to the book also contains an essay about the contents of the book, usually written by someone other than the author. The acknowledgement page contains the names of special individuals or organizations that aided the author in one way or the other in the creation of the book. The dedication page contains the names of loved ones who motivated the author while the book was being written. The dedication and acknowledgement pages generally hold a special place in the minds of authors, especially if the book turns out to be a success.

The main text is usually the most important section of the book. In this section, much thought must be given to the reader, the design of the image area, the margins of the pages, the type style, and the type and quality of paper. The main text contains all the written materials and illustrations. In short, there is no book without this section.

The reference section, or end matter, contains supplementary information such as the appendix, glossary, notes, index, bibliography, colophon, and so on.

Book Production Process

Book production, according to Anikpo (1980), are the stages through which an author's manuscript has to pass before it becomes a bound book. The process involves the editorial process, the actual printing, and the publishing operation. In other words, the author, the editor, the printer, and the publisher must all be actively involved. They must cooperate with each other if the book is to see the light of the day. The production of a book is, therefore, like an assembly line production. It moves from one step or stage to the next, and at each stage experts involved with that stage do their work.

The question then arises, "Who are these experts?" In attempt to answer this question, we shall look at the three key people, the author, the publisher/editor and the printer. The author is the one whose ideas on a subject are written down to produce a new book. There are full-time authors, who write as many books as they have the time to write. There are also freelance writers, who are occasional writers.

The publisher is a businessperson who organizes and coordinates all the resources for book production. Because publishers are businesspersons, they take the financial risk of investing in book production once a decision to publish a work has been made. "The true publisher," says Dessauer (1974), "moves with equal comfort in the world of mind and art and in the world of commerce." According to Anikpo (1980) publishers would go out of business if they did not run their affairs efficiently enough to make adequate profits. Publishers, because of their business acumen, are able to coordinate the work of many others such as the author, editor, designer, typesetter, printer, binder, distributor, and wholesaler. According to Boardus (1981), publishers combine talents, activities, and machines so that ideas in the mind of an author are "made public" and get to the bookshelves of home, office or library. Bailey (1970), of Princeton University, speaks of the publishing house as an institution which both reflects and influences society, "permeated with the interest and variety and excitement of books it publishes."

Printers are technicians, and without their technical expertise, books will not be printed. According to Anikpo (1980), the printer has the equipment and expertise to print and bind a book in accordance with the publisher's directive. Printers work for a fee that the publisher has agreed to pay, and are not concerned with the success or failure of the books once they are printed and delivered to the publisher. This does not imply that the printer will perform a substandard job for the publisher.

Steps in Producing a Book

A book begins with an idea in the mind of the author. The idea is then written down on paper as a manuscript. A manuscript can be described as an unprinted handwritten, typewritten, or word processed form of a book.

A manuscript for a proposed book can be acquired by a publisher as an unsolicited manuscript from a freelance author or a literary agent. Alternatively, a manuscript may be written on commission, in which case the publisher assigns a topic to a freelance writer, a full-time author, or a staff writer.

After the publisher has accepted a manuscript, it is given to an editor whose job it is to make sure that it meets the publishers specifications regarding style, length, and organization. In editing the manuscript, editors may make minor changes, suggest revisions to the author, or make major revisions themselves. After editing, the manuscript is given to the copy editor who may do considerable rewriting, search for grammatical, spelling, and punctuation errors, corroborate facts, correct discrepancies in style, and perhaps help cut the copy to a predetermined length. It is also the job of the copy editor to coordinate entries in the bibliography with the citations in footnotes, if any. Copy editors ensure also that chapter headings correspond with contents. It is the job of the copy editor to relate pictures, tables, charts and the like to the text.

After copy editing, the manuscript is given to the graphic designer. The graphic designer decides on the type style and size, the placement of photographs and drawings, and all other aspects of general format. In essence, the designer draws a "blue-print" of the book in much the same way that an architect plans the layout of a house. The designer then gives the text part of the book to a typesetter or compositor. The compositor's or typesetter's job is to set the letters, words, and sentences in the proper type style and size with the amount of spacing specified by the designer.

After typesetting, the book is given to the paste-up department. Here all the type, drawings and photographs are assembled into pages just as they will appear when the book is printed. From the paste-up department, the book moves to camera department where camera operators photograph the pasted-up pages with a special camera called a process camera. The camera uses high contrast film to make a negative of an entire page.

The next step is the assembling of the negatives of the pages to special marking sheets of grid paper cut to the size of the printing plate. Each page of the book is fastened to the grid paper in such a way that when the book is printed the pages will be in the correct

sequence. When these negatives, called flats, are completed for the entire book, they are sent to the platemaking department.

In the platemaking department, plates are made by the platemaker for each press run in readiness to print the book. To print the book, a web press using continuous rolls of paper may be used. Alternatively, a sheet-fed press, which prints on flat sheets of paper, may be used. Or, a combination of the two presses may be used for different parts of the book depending on the number of colors required on a given page. These presses can print many thousands of copies per hour from the plates made by the platemaker.

Printing is not the end of the process. The printed pages must be folded, placed in order, bound, and covered before the book is completed. These activities are collectively called finishing operations and are usually done in the bindery. Machines fold and cut the pages into sets called signatures. These signatures are gathered together to form a complete book. A cover is added and the book is completed.

It is important to note that many people with various expertise are needed to produce a book. In addition to those people involved in the actual production of the book, many others work in industries which manufacture machines or materials used in the production of books. The two most important materials are paper and ink. Paper and ink are made in various kinds and colors. For most books, black ink is printed on white book paper, which is available in both sheets and rolls.

Conclusion

Many consumers of the end product of book production are either unaware of, or do not care about, the rigorous processes that go into making the books they consult daily for one reason or the other. While most book readers can still enjoy books without knowing how they are produced, those in the Graphic Communications industry can ill afford to be so aloof. For this reason, this writer decided to give a brief overview of the book production process.

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Measuring Dot Gain from Film to Plate: Murray-Davies or Yule-Nielsen Equation?

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Introduction

In graphic arts, dot gain (from film to paper) is the difference between the dot area on the film and the dot area of the plate or printed sheet. Dot gain can occur during color separation, film contacting and platemaking, and on press when ink is printed on paper. This change in dot size is inherent in printing processes that require thin layers of ink to be transferred from one medium to another. It has been recognized by the printing industry that dot gain is one of the most critical factors associated with printing quality in the lithographic process. For many years, dot gain has been one of the measured values for quality improvement and standardization in printing.

Total dot gain is the difference between the dot area on the film, as measured with a transmission densitometer, and the dot area on the printed sheet, as measured with a reflection densitometer (GATF staff, 1995). It consists of both physical (also called mechan-

ical) and optical dot gain. Jackson (1990) defined physical dot gain as the total physical increase in halftone dot size that occurs at each image transfer stage between film steps and printed press sheets. Killeen (1995) explained that optical dot gain is a visual phenomenon created because of the light-absorbing characteristics of ink and the light-scattering characteristics of the substrate. When light hits the non-image area, or "white space," it is scattered and some of the light is absorbed below the halftone dots. This light cannot be reflected back to the eye and is said to be "absorbed." Dots appear darker and larger than their actual density and size due to the scattered light being absorbed by the ink and paper. It is important to note that dot sizes are not physically changed, but they appear as if dot gain has occurred. A graphic explanation of total dot gain is shown in Figure 1. As shown in the figure, the physical dot gain is 15% and the optical dot gain is 2%; therefore, the total dot gain is 17%.

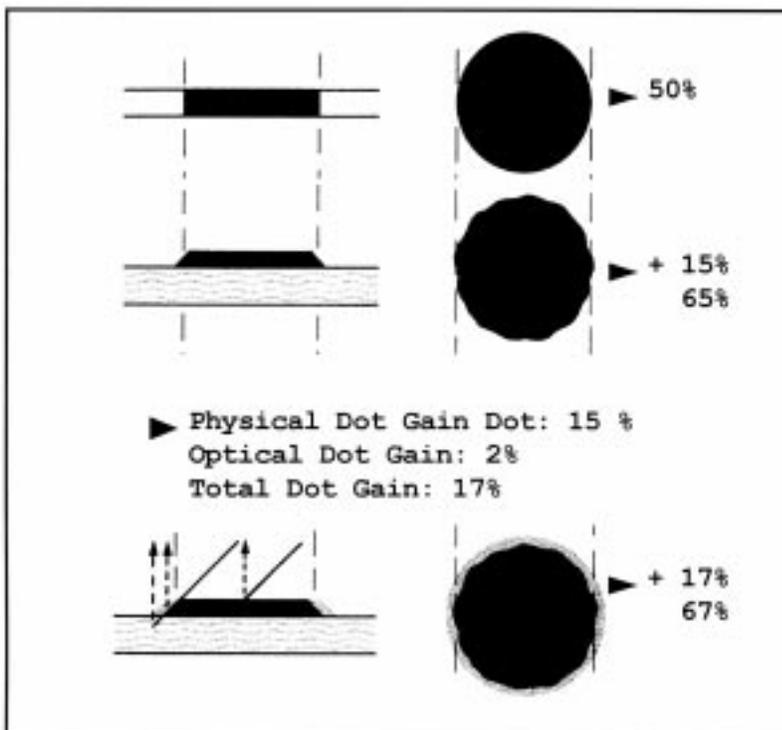


Figure 1: Total dot gain is a combination of the physical increase and the optical increase in dot size.

MEASURING DOT GAIN

Uncontrolled dot-size change will seriously distort tone and color reproduction. Better control of dot-size change means better control of color. Better control of color will reduce rework and scrap, lower costs, and increase productivity. Therefore, it is necessary to monitor dot gain during the platemaking process closely, establish a standard that will match the chosen proofing system, and then maintain that standard in the prepress room (Prince, 1994). Southworth and Southworth (1989) stated:

Since dot gain variation has the greatest influence on color variation, it is important to understand how to control and compensate for it. If controlled, dot gain is not necessarily bad—which is just as well, because dot gain is inherent to every printing process. (p. 13, Chap. 14).

Thus, dot gain variation must be measured and controlled. Even though dot gain cannot be eliminated, its effect can be compensated for and minimized.

USING A DENSITOMETER TO CONTROL AND IMPROVE PRINTING

The densitometer, one of the most widely-used instruments to measure dot areas, provides important information necessary to control and improve the printing process (GATF, 1995). Generally, dot gain is measured from solid and tint values by densitometers. A densitometer can measure dot area, density, trap, hue error, grayness, and printed contrast of either black-and-white or color tone areas on transparent or opaque materials (GATF, 1995). Brehm (1992) defined densitometers as instruments designed to determine, indirectly, the light absorbed by a surface. Brehm also indicated that there are two kinds of densitometers: transmission and reflection.

- Transmission densitometers measure the amount of light that is transmitted through a transparent material such as a film base.
- Reflection densitometers measure the amount of light reflected from a print and are a critical aid in quality control for all involved in the printing production process.

The formulas for measuring dot gain have been available for almost sixty years through the studies conducted by Eastman Kodak (Murray, 1936). Most modern densitometers use the Murray-Davies and/or Yule-Nielsen equations to calculate dot gain.

MURRAY-DAVIES (MD) EQUATION

In 1936, Alexander Murray, of Eastman Kodak, expressed the relationship between reflection density of halftone prints and dot area. Murray's study (1936) is the origin of the Murray-Davies equation. The Murray-Davies equation considers both the mechanical and optical aspects of dot gain. Comparing the value of a printed dot area (measured with a reflection densitometer) with the value observed on the corresponding film (measured with a transmission densitometer) provides a dot gain value. The Murray-Davies equation has been accepted as the standard for calculating apparent total dot gain (both physical and optical). The Murray-Davies (MD) equation is (ANSI/CGATS.4-1993, 1993, p. 7):

$$\% \text{ apparent dot area (both physical and optical dot)} = \frac{100 \times [1-10-(D(t)-D(p))]}{[1-10-(D(s)-D(p))]}$$

where (using the appropriate filter for the colorant being measured);
D(s) is density of the solid;
D(t) is density of the tint;
D(p) is density of the paper/substrate.

YULE-NIELSEN (YN) EQUATION

The Yule-Nielsen equation is a modification of the Murray-Davies equation and is used to estimate physical dot area. It includes an "n factor" for paper, which varies according to the type of paper, ink, and screen ruling used, and yields a result which expresses only physical dot area (Yule & Neilsen, 1951). The Yule-Nielsen modification removes the light-scattering effect (optical effect), and separates the physical dot area measurement from the optical dot gain measurements. Accordingly, the formula will yield dot measurements significantly lower than those obtained with the Murray-Davies equation.

The Committee for Graphic Arts Technologies Standards (ANSI/CGATS.4-1993) stated that:

An empirically determined factor "n" is included to calculate an approximation of physical dot area resulting from the use of specific raw materials (ink, paper, substrate, etc.) used in the printing process. (p. 7)

The Yule-Nielsen equation is (ANSI/CGATS.4-1993, 1993):

$$\% \text{ estimated physical dot area} = \frac{100 \times [1-10-(D(t)-D(p))/n]}{[1-10-(D(s)-D(p))/n]}$$

where (using appropriate filter for the colorant being measured);
D(s) is density of the solid;
D(t) is density of the tint;
D(p) is density of the paper/substrate;
"n" is an empirically determined factor, by trial and error, that must be determined for each set of raw materials. (p. 7)

It is important to note that the Yule-Nielsen equation reverts to the Murray-Davies equation when the value of n in the equation equals one. In 1980, Pearson intended to determine an optimum value for the "n" factor. Pearson (1980) recommended:

...the choice of an n value between 1.4 and 1.8 can result in improved accuracy of dot area calculations for most practical conditions and is feasible for those cases where a background of experience and data with other values does not already exist. For practical reasons a specific value of 1.7 is recommended. (p. 415)

There are other methods of measuring dot gain, such as the Neugebauer Equations and System Brunner, but they are not as widely accepted as Murray-Davies and Yule-Nielsen equations by the printing industry in the United States.

Problem and Purpose of the Study

Dot gain is a characteristic defect, and a built-in integral part, of the offset lithographic printing process (Bruno, 1986). In this study, dot gain refers to the difference between the dot area on the film used to make the plates and the dot area on the plates. Dot gain can cause an overall loss of definition and detail, color changes, and problems with contrast, ink hues, ink density, and trapping (Killeen, 1995). For example, if the dot grows more than it should, the color on the print will be darker and the desired color will not be obtained. Color variation is probably the largest single problem in offset lithography. Unfortunately, dot gain has the greatest influence on color variation, so the benefits of understanding, controlling, and compensating for dot gain are obvious ("Dot gain: Causes and cures," 1982). Dot gain from film to plate is caused by the nature of the printing process. Therefore, it is not possible to entirely eliminate it. However, to minimize color variation, controlling dot gain from film to plate is the first key element. The key problem is how to accurately and consistently measure dot gain from film to plate, or to be more precise, how to accurately and consistently measure dot areas on offset printing plates using reflection densitometers.

Many studies and the Committee for Graphic Arts Technologies Standards (CGATS), accredited by the American National Standard Institute (ANSI) in 1989, recommend that transmission densitometers employing the Murray-Davies (MD) equation should be adopted by the graphic arts industry to measure dot area on film (ANSI.CGATS.9-1994, 1994). The question remains "How should dot area on the plate be measured?" Can reflection densitometers read printing plates accurately? Are reflection density readings made from printing plates reliable and accurate? Densitometer manufacturers, offset printers, and researchers in the field of offset lithography

do not agree to the answers to these two questions. R. D. Cavin (personal communication, May, 1996) and A. P. Stanton (personal communication, May, 1996) emphasized that:

- reflection readings from printing plates using densitometers do not, in many cases, provide realistic dot areas for highlight and quartertone values.
- several studies have indicated that dot areas calculated from reflectance measurements on printing plates are not always predictive on press.

The purposes of this experiment were twofold: (1) To investigate the correlation between the reflectance readings on printing plates using densitometers and the readings obtained from an optical image capture system (OICS) provided by the Image Analysis Facility at Iowa State University; and (2) Determine whether the Yule-Nielsen equation with an appropriate "n" factor is a better method for measuring dot areas on printing plates than the Murray-Davies equation.

Assumptions and Limitations

It was assumed that operator effects, film and plate performances, and press performance were consistent. Due to time and resource limitations, only twenty Fuji PS negative-working printing plates were exposed for the study. Furthermore, the instruments used in the experiment were assumed to be reliable and valid based on the manufacturers' specifications.

Methodology

This study compared two correlations. The first was the correlation of the calculated dot gain percentage of twenty Fuji negative-working plates using the Murray-Davies (MD) equation and the calculated dot gain as measured by an optical image capture system (OICS), that is, R MD.OICS. The second was the correlation of the calculated dot gain percentage of the same plates using the Yule-Nielsen (YN) equation with an appropriate "n" value and the calculated dot gain as measured by the OICS, that is, R YN.OICS. The OICS readings served as the reference for the comparisons.

DETERMINATION OF THE "N" FACTOR FOR YULE-NIELSEN (YN) EQUATION

The YN equation requires an appropriate "n" factor for reading offset printing plates. The "n" factor was

calculated through a standard procedure recommended by the manufacturer of the densitometer used in the experiment. This procedure requires that a 50% screen be established first. This was accomplished using plates with gray tints in 1% increments from 40% to 60%. The 50% tint was visually observed at the point where the dot pattern shifted from positive to negative and the pattern appeared to be a perfect checkerboard. When properly established at the 50% tint, the “n” factor then established produces good results for all other dot areas samples under the same printing conditions (PlateMaster instruction manual, 1994). It is important to note that four studies (Yule & Nielsen, 1951; Pearson, 1980; William & Compton, 1989; ANSI/CGATS.4-1993, 1993) indicated that there is not a good mathematical basis for any given “n” value, and the proper determination of the value is usually dependent on an expert observer. However, based on the above procedure, the “n” value for this experiment was determined as 1.34.

MEASURING DOT AREA ON THE FILM

The measurement of dot area on the computer-generated film was done with an X-Rite 361DTP, a transmission densitometer employing the Murray-Davies equation (X-Rite, 1994). The densitometer was zeroed on the film base before measuring the dot area on the film. This densitometer was also used to calibrate and linearize the imagesetter. Measuring the dot area on the film generated by the imagesetter using an X-Rite 361DTP transmission densitometer was an important procedure to ensure that the imagesetter was linearized. In other words, there was zero gain on the computer-generated film because

the imagesetter was verified to be at a stage of linearization. For example, 50% dots on the film were read as 50% by the transmission densitometer.

CONTROLLING PLATE EXPOSURE

Extreme care was necessary during the platemaking process to ensure that dot gain from film to plate was consistent on all the plates (say, 6%). Extreme care was taken to standardize the exposure and development times to achieve the same percentage of dot gain on all the plates used during the experiment. Two plate control guides, listed below, were used to monitor plate exposure:

- Fuji Guide (15-Step Transmission Sensitivity Guide), i.e., solid step #3.
- UGRA Plate Control Wedge to control plate exposure, i.e., solid step #4.

MEASURING DOT AREA ON THE PLATES

Two systems were selected to measure dot area on the plates experiment for the purpose of evaluating the strength of the associations among the measurements:

- Reflection densitometer: Betalog PlateMaster (Beta Industries),
- Optical Image Capture System at the Image Analysis Facility at Iowa State University.

EXPERIMENTAL CONDITIONS

Many variables affect dot gain from film to plate in the offset printing process. It is not possible to control all the variables at the same time. Table 1 summarizes the primary variables that were controlled and how they were controlled.

DATA COLLECTION

Data were collected at the Iowa State University printing plant during the experiment. Twenty Fuji PS negative-working printing plates were exposed to the same degree as determined by the UGRA Plate Control Wedge to ensure that the dot gain from film to plate was standardized. The densitometer

Variables	Materials/Equipment	Controlled or Not
Dot Shape	0.9 Ellipticity	Yes
Screen Ruling	133 lines per inch (lpi)	Yes
Imagesetter	Panther Pro 36 by Prepress	Yes (Linearized)
Plate Exposure Control	Fuji Guide T & UGRA Plate Control Wedge	Yes
Platemaking Room Temperature	76o F (24.44o C)	Yes
Platemaking Room Relative Humidity	52%	Yes
Expert Observer for determining the “n” value	Rob Louden n = 1.34	Yes
Platemaking Operator	same person for the 20 plates	Yes

Table 1: Experimental conditions

Plate	OICS25	MD25	YN25	OICS50	MD50	YN50	OICS75	MD75	YN75
1	5.88	7.50	2.46	7.45	9.43	2.56	4.40	6.96	0.76
2	6.86	7.51	3.44	8.47	9.56	3.85	5.35	6.98	1.90
3	5.16	6.95	2.21	6.70	8.83	2.27	3.69	6.74	0.49
4	6.92	8.02	3.22	8.53	10.04	3.55	5.41	7.17	1.63
5	5.28	6.80	2.44	6.82	8.70	2.58	3.81	6.69	0.76
6	5.78	7.07	2.38	7.35	9.01	2.40	4.30	6.80	0.65
7	5.15	7.06	2.05	6.69	8.93	2.04	3.68	6.78	0.29
8	5.64	7.58	2.43	7.20	9.48	2.58	4.16	6.99	0.74
9	6.25	7.81	2.91	7.83	9.77	3.22	4.75	7.08	1.30
10	6.48	7.41	2.89	8.08	9.42	3.06	4.99	6.94	1.23
11	6.51	8.29	2.76	8.11	10.25	2.99	5.01	7.27	1.11
12	5.56	7.36	2.61	7.11	9.26	2.85	4.08	6.90	0.97
13	6.12	7.54	2.88	7.70	9.49	3.16	4.63	6.98	1.26
14	5.74	7.59	2.53	7.31	9.50	2.71	4.26	6.99	0.86
15	6.50	7.39	3.03	8.10	9.40	3.28	5.00	6.93	1.41
16	6.79	8.24	3.33	8.40	10.24	3.80	5.28	7.25	1.79
17	6.52	7.99	2.57	8.11	9.97	2.63	5.02	7.16	0.84
18	6.25	7.74	2.56	7.83	9.70	2.65	4.76	7.06	0.85
19	6.10	7.71	2.73	7.68	9.66	2.95	4.61	7.04	1.08
20	6.90	7.89	3.23	8.52	9.91	3.55	5.40	7.12	1.63

Table 2: Dot gain percentages for the twenty plates

used to read the plates was calibrated and maintained based on the manufacturer's recommendations to assure data consistency and reliability.

The 20 plates were measured by a Betalog PlateMaster reflection densitometer using both the Murray-Davies (MD) and Yule-Nielsen (YN) equations. The Betalog PlateMaster is specially designed to measure offset printing plates. Readings of the 25%, 50%, and 75% dot areas on the plates were recorded and analyzed using the SPSS software package. Further, the Optical Image Capture System (OICS), facilitated by the Image Analysis Facility at Iowa State University, was used to assess the consistency of the reflection readings obtained from the densitometer. A description of the OICS can be found in Appendix A. Table 2 displays the 180 observations of the dot gain percentages from film to plate categorized by 25%, 50%, and 75% tints using MD, YN, and OICS methods.

Results and Findings

Table 3 summarizes the general descriptive statistics of the observations categorized by the three dot sizes and three measuring methods. The table indicates that the 50% dots have the greatest gain, followed by the 25% and 75% dots. Each of the measuring methods provided similar results.

	OICS25	MD25	YN25	OICS50	MD50	YN50	OICS75	MD75	YN75
Mean	6.1192	7.5727	2.7322	7.6996	9.5280	2.9349	4.6293	6.9917	1.0771
Std. Dev.	0.5757	0.4089	0.3786	0.5996	0.4386	0.4997	0.5622	0.1605	0.4380
Minimum	5.15	6.80	2.05	6.69	8.70	2.04	1.73	6.69	0.29
Maximum	6.92	8.29	3.44	8.53	10.25	3.85	3.68	7.27	1.90
N	20	20	20	20	20	20	20	20	20

Table 3: Descriptive statistics

The main purpose of this study was to determine whether the Yule-Nielsen equation with an appropriate "n" factor is a better method for measuring dot areas on offset printing plates than the Murray-Davies equation. A Pearson Product-Moment Correlation analysis was performed using SPSS to study the degree of association between the densitometer and OICS readings. The results of the correlation analysis are presented in Table 4. As shown in Table 4, both the densitometer readings using MD and YN equations were significantly correlated with the OICS readings for all of the three tints ($p = .000$ for all of the correlation coefficients). Table 4 also shows:

- $R_{YN.OICS.25} (.8920) > R_{MD.OICS.25} (.7658)$,
- $R_{YN.OICS.50} (.8546) > R_{MD.OICS.50} (.8256)$, and
- $R_{YN.OICS.75} (.8715) > R_{MD.OICS.75} (.7926)$.

These results suggest that the Yule-Nielsen readings were better correlated with the OICS readings than the Murray-Davies readings for all three of the tints. It was concluded that the Yule-Nielsen equation, with an appropriate "n", factor is a better method for measuring dot areas on offset printing plates than the Murray-Davies equation. (In this study, the value for the "n" factor was 1.34.)

Recommendations

To improve the accuracy of the "n" factor, this study proposes that an optimum "n" factor for specific raw materials used in the printing process (ink, paper, and so on) can be determined using statistical methods. A correlational study is recommended to investigate how well the dot area readings of printing plates measured using the Yule-Nielsen (YN) equation, in combination with various sets of "n" values obtained from different observations made at the 50% dots (checkerboard-like

dots), correlate with the measurements obtained from an optical image capture system (OICS). The optimum "n" value should then be determined based on the strength of the association between the YN and OICS readings. That is, the optimum "n" factor will be the one having the greatest correlation coefficient. Further research is also needed to study the accuracy, consistency, and inter-instrument agreement for reflection densitometers designed specially for reading lithographic plates.

Appendix: Description of the Optical Image Capture System

MATERIALS AND METHODS:

Images of the plates were acquired by the Image Analysis Facility at Iowa State University using an SGI Indigo 2XZ equipped with a Galileo frame grabber board (Mountain View, CA) and a Sony DXC-3000A color video camera (Itasca, IL) with a Carl Zeiss 60mm macro lens (Thornwood, NY). They were then analyzed using Noesis Visilog image analysis software (version 4.1.4, St. Laurent, Quebec).

The internal scaling feature of the image analysis software was calibrated to measure in millimeters. Input images were processed to maximize contrast between the dots and the background, providing a

distinct thresholding point. The resulting dot area and total area were measured and percentages calculated.

ACKNOWLEDGMENTS:

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Pearson Correlation	OICS25	OICS50	OICS75
MD25	0.7658 (R _{MD,OICS.25}) (20) ^c P = .000 ^d		
YN25 ^b	0.8920 (R _{YN,OICS.25}) (20) ^c P = .000 ^d		
MD50		0.8256 (R _{MD,OICS.50}) (20) ^c P = .000 ^d	
YN50 ^b		0.8546 (R _{YN,OICS.50}) (20) ^c P = .000 ^d	
MD75			0.7926 (R _{MD,OICS.75}) (20) ^c P = .000 ^d
YN75 ^b			0.8715 (R _{YN,OICS.75}) (20) ^c P = .000 ^d

^a measurements were made on the twenty plates
^b "n factor" = 1.34
^c (cases)
^d two-tailed significance

Table 4: Pearson correlation for the dot gain readings using the three methods from the plates.

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The Network Server: An Educational Tool for the Graphic Arts Classroom

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Introduction

The digital revolution has drastically changed the way people work in the graphic arts industry. In the past, craftspeople worked with tactile materials. Lead type, wooden furniture, slugs, shims, string, and mallets were all used to create the image on the page. With the evolution of lithography, these materials were replaced with film, typeset paper, flats, and stripping materials. While the printing process changed, physical materials were still the basis of image development.

Today's technicians work with digital data, touching nothing but a computer mouse and a keyboard. Gone are the tangible materials that defined the craftspeople of the past. Operators may now create a finished product without ever holding a single piece of original copy. The large manilla folders, overflowing with comprehensives, job sheets, and mechanicals, are being replaced by electronic files and folders. The movement from design and image creation to image assembly, plate, and press now occurs over network data lines.

While the complete elimination of hard copy is not recommended, the transformation into a digital environment requires managers and educators to rethink current workflow. As documents and materials are electronically created and delivered, the traditional methods of information access no longer apply. "Sneaker net" may work in a pinch, but it is not the most effective information delivery system. Today's digital environment requires network connectivity between client, industry, and workstations. The network server is a logical addition for this basic transfer of information.

Background

A network file server is a specialized high performance computer with a large capacity hard drive. It is designed to store and retrieve data, translate files between operating systems, and print files from workstations to printers throughout the network. Linking faculty offices, student laboratories, and remote sites, the network server supports the educa-

tional environment as a tool for teaching the importance of a digital workflow.

A network server aids in the transfer and storage of files, images, and information. It also provides individual workstations with access to various input and output devices. Connectivity between work stations and peripherals is the ultimate goal. The server becomes the master link in the information chain.

Increased workflow and specialization of computer applications have made operation of a network server in a prepress environment a formidable challenge. Huge files must be moved to various workstations before being output to imagesetting or platesetting systems. The flow of this information is the heart of the prepress portion of the graphic arts industry. While profits still require "ink on the paper," the smooth operation of networks and network servers is critical for the current work environment.

The network server becomes the "linchpin" in the technologically advanced world of computer prepress (Streeter 1995). While similar to their counterparts in the business environment, network servers for the printing and publishing industry are unique. Single workstations within many prepress facilities generate as much traffic as a complete department within some businesses. File sizes of 50–200 MB are common. These large files require unique and specialized equipment to handle the load (Miley 1995).

Educational Use

As traditional workflow methods move toward a digital environment, the graphic arts industry looks to educational institutions to teach digital workflow. Employers expect graduates to have these specific skills. Therefore, students in graphic arts education need to understand digital work flow methods used in the industry.

The use of a network and network server in a graphic arts laboratory prepares students for the environment within the printing industry. Networks can offer advantages and opportunities for many educational disciplines. Students and teachers can access course materials from the classroom, across campus, a remote work-

site within the city or county, or even across the state. This connectivity creates a creative working laboratory that ignores the traditional boundaries of the classroom. Early exposure to the system idea helps prepare students for what may be encountered in the industry.

Username are loaded into the system to give persons access to the network. Once users are on-line, they can be assigned to specific groups. These groups help define access privileges. Persons can belong to one or more groups, each with varying access and user options. This simplifies the "housekeeping" tasks of the network supervisor. For example, adding a user to the group "student worker" may provide the student with more privileges than the "student" group. Removal from the group "student worker" eliminates the additional privileges but retains the original access privileges.

The large hard drive of the server is divided into different areas called volumes. As with drawers in a filing cabinet, items or information stored within each volume have a common theme. Software, students, and faculty are examples of names that could be used for volumes. Accurate volume names help users in locate desired information. Access privileges to these volumes are controlled through the defined groups. These privileges are designed to allow maximum collaboration and adequate security for the users involved. This flexibility allows multiple options to tailor the server to each application.

A goal of the network server in industry is to maximize workflow in a digital environment. This idea can

be applied to the educational setting, whether in a graphic arts laboratory or in other technology disciplines. An example of using network servers can be the delivery of course material to students. This basic server/network function constitutes information storage and retrieval. Course outlines, notes, and modules can be stored in locations designated for specific courses. Students can locate and copy desired files but may not have the privilege to alter them. This provides students with 24-hour access to course information and materials. It also frees the instructor from providing extra materials to students who have missed class. If students fail to receive assignments or handouts, they can download the material from the server. Computer-based training modules, simulation modules, and slide presentations can also be made available to students through the server.

Students' use of the network to collaborate on projects is another example of using technology to enhance learning. Different group members can provide input on projects and store their work in a common-access storage area. Other students can access the file, comment, contribute, and return the file to the storage area. This is an especially effective way for students to participate in group projects. Collaboration takes place at the convenience of the student—it does not require a common meeting place. The flexibility of the network server eases this collaborative effort.

The Network Server at Ball State University

The Industry and Technology Laboratory (ITLAB) server is a Hewlett Packard, server-class computer with 64 MBs of RAM and a 9 GB hard drive. The layout of the network is seen in Figure 1.

Using Novel Netware as the network software, the server supports the transfers of files between Macintosh and Windows operating-system platforms. Workstations are connected through Ethernet to link together the ITLAB server and the Ball State University (BSU) computer network. Flatbed, slide, and drum scanners are attached directly to computer workstations. Laserprinters, color thermal wax printers, and dye sublimation printers are connected to the network through remote print servers that convert Ethernet to LocalTalk. Print ques for each device reside on the server so students can access any printer on the network. A high resolution imagesetter and drum scanner are connected to the network through a Macintosh workstation. Access to the imagesetter is restricted to eliminate the indiscriminate use of this device. The ITLAB network also provides access to Ball State's other computer labs plus students dorms, student apartments and the outside world via the Internet and the World Wide Web.

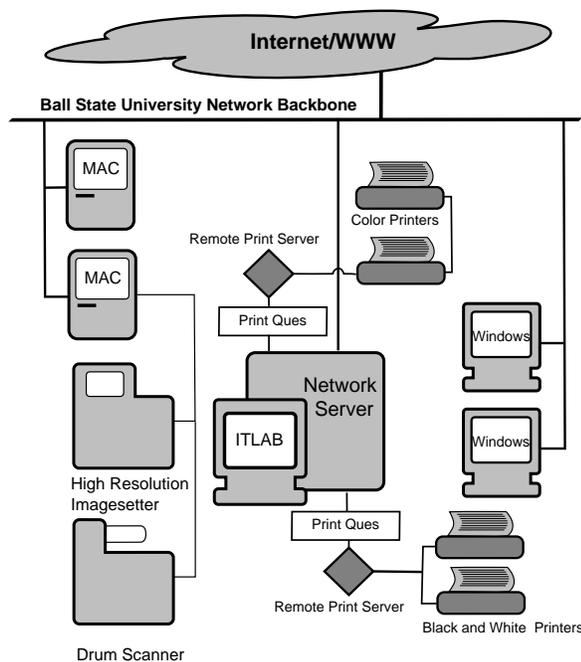


Figure 1.

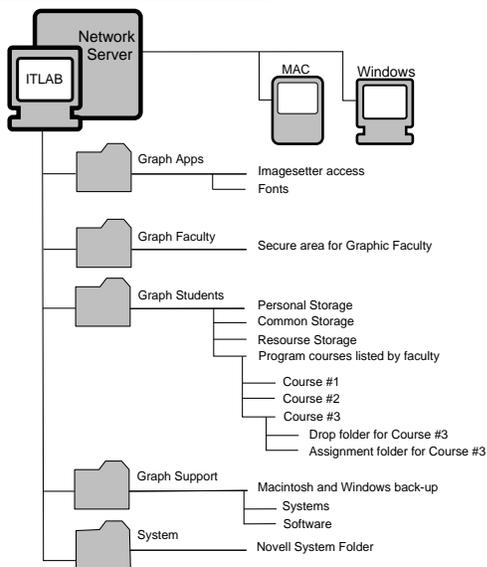


Figure 2.

The ITLAB server is available to both students and graphic arts faculty. At the beginning of each semester, students are processed as a group and entered into the ITLAB network as users. Students make up the core group within the ITLAB server labeled Everyone. Other sample groups include student workers, graduate assistants, faculty, and the network supervisor.

A list of the ITLAB volumes is presented below and also shown in Figure 2. These volumes use descriptive names to aid the student in locating desired materials.

GRAPH STUDENTS

This is the main area for students enrolled in Graphic Arts courses. It includes a common folder for collaboration, a resources folder for frequently-used logos and headings, and faculty folders for course materials. Students can turn-in completed class assignments, copy assignments or class materials, collaborate with different students, and copy frequently-used artwork within this volume of the ITLAB server.

GRAPH FACULTY

Within this volume of the server, faculty have their personal, common, and resource folders. Access to this area is restricted to faculty.

SUPPORT

This server volume holds backup software for the complete graphic arts laboratory. Access to this volume is provided to the student workers, graduate assistants and the graphic arts faculty. This simplifies the maint-

nance and loading of software within the laboratory. It also reduces the problem of lost or misplaced software media because workers do not handle original disks.

GRAPH APPS

The Graphic Applications volume provides controlled access to the Adobe Image Club library of fonts and to the high-resolution imagesetter.

SYSTEM

The Novell System is stored in this area of the server. It is best described as the "operation system" of the server. Access is limited for all users to allow the basic functions of the network.

Student Use

An introduction to a digital workflow was an objective of the ITLAB network server. Without student participation, this goal would be lost. Therefore, an informal survey of several of classes was conducted to judge the effectiveness of the ITLAB server by assessing how often students use the server, how the network is being used, and who is using it. The survey also helped identify potential problems to better address the needs of the users.

GENERAL DEMOGRAPHICS

Seventy Ball State University students participated in the survey. Ninety-nine percent were full time students. Seniors accounted for 46%, 27% were juniors, 17% were sophomores, 7% were first year students and 3% were categorized as "other." Sixty-seven percent were male, and 33% were female. The classes surveyed were Graphic Arts Management/Printing Technology courses, which served Graphic Arts students as well as those majoring in other disciplines. Sixty percent of the students surveyed were Graphic Arts Management majors, 14% were Journalism majors, 16% were Telecommunications majors, and 10% were other students (see Figure 3).

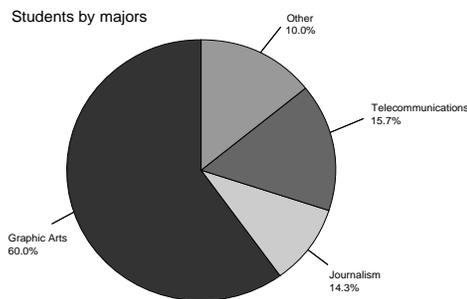


Figure 3.

FREQUENCY OF USE

The survey revealed that 73% of responding students used the ITLAB server more than twice a week. Uses included retrieving information, getting assignments from the professors, handing in assignments, or working jointly with other students. Seventy-six percent of the students agreed that the network server facilities helped them in their course work. Fourteen percent either disagreed or strongly disagreed, while 10% had no opinion (see Figure 4).

UNDERSTANDING

When asked if they understood the server function, 84% of the students responded that they understood the operation of the server as it relates to class work. Only 13% disagreed with that statement and approximately 3% had no opinion. It is interesting that 59% of the students completing this questionnaire reported owning their own computer.

REMOTE ACCESSING

One positive attribute of the network support on the Ball State University campus is that all of the computer labs and student housing are networked. Therefore, students have remote access to the ITLAB server from the dorm rooms and the BSU student apartment complex.

Figure 5 shows student remote access to the server was varied. Thirty-one percent of the students responded that they log-on to the server at least once a week from one of these remote sites. Sixty-nine percent of the students have never used the remote log-on capabilities.

WHO IS USING THE SERVER?

The survey revealed who used the system and provided hints as to why others did not use it. Most of the students enrolled in courses used the server for related class work. Though remote access is available, many students did not use this feature. Students became comfortable using the system within the graphic arts laboratory and did not venture to the other BSU computer labs. To promote remote use, laboratory assignments could include the requirement to reach the ITLAB server from a remote site. It would be an advantage for students to become more comfortable with alternate laboratories on campus because many of them are available for more hours than the graphics arts laboratory. This would introduce students to other computer laboratories.

While the use of the server is strong, it is not universally used in all courses. A greater effort is needed to promote its use. Faculty members and students should be taught the capabilities and features of the system. Its positive aspects should be emphasized to both students and faculty to ensure users have a full understanding of the system.

Results

One goal of the ITLAB server was to introduce the use of a digital workflow to the graphic arts students. Use of this technology provides a strong base of information that students can take with them to the workforce upon graduation. The indication is that this goal has been met. Students are using digital work-flow technology and frequently log-in onto the system. Software maintenance has also been improved. The network server has also simpli-

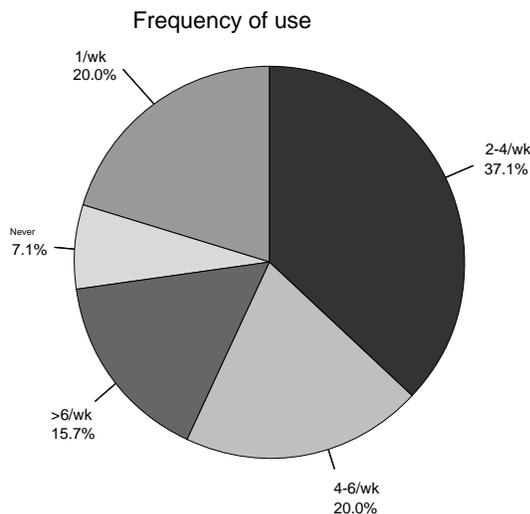


Figure 4.

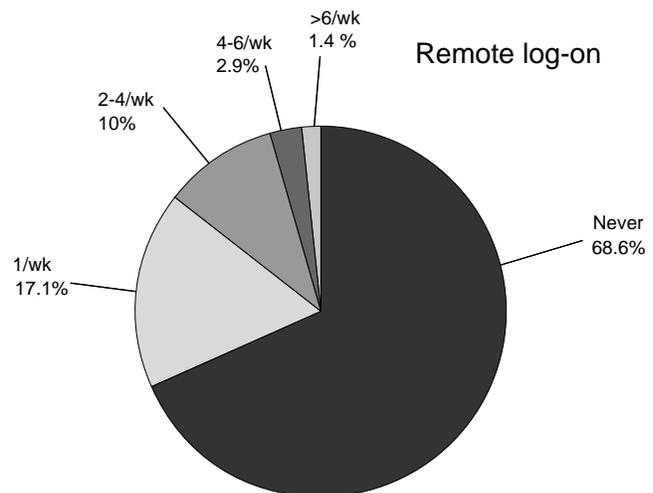


Figure 5.

fied the management function of the computer laboratory. Corrupted software files can be quickly reloaded with the help of the network servers' support volume. Operation of the network server is improving as the system is expanded.

Potential Barriers

While the introduction of the digital workflow to the graphic arts student at Ball State University has been positive, some problems exist. Setting up networks and network servers requires extensive forethought, planning, and communications. Some barriers to its use are provided in the following paragraphs.

PREREQUISITE SKILLS

Students often lack skill in accessing and using networks. Providing additional materials may be necessary to support students' use of the server. If the user lacks the basic computer skills, some means of providing these skills will be necessary. These may include referring users to available university-wide workshops on computing, requiring prerequisite classes before students use the system, or providing remedial workshops to build the skills. Users can become easily frustrated and quickly discouraged with the system if educational opportunities are not available.

HARDWARE/SOFTWARE PROBLEMS

For a computer system to be effective, it has to run smoothly. Adequate technical support is necessary to ensure the operation of computers, printers, and other peripheral equipment. Software and hardware support is essential to alleviate problems that are inevitably encountered.

DUAL PLATFORMS

Translation and conversion between software packages and operating systems are not automatic. Expertise on software versions and operating systems is required to maintain dual platforms.

UNDERSTANDING NETWARE

The network supervisor must understand the required netware software. Support for this area is crucial. Adequate technical support for installation and continued maintenance needs to be included in a budget. The network server must run smoothly and be operationally sound.

ACCEPTANCE OF CHANGE

People are typically reluctant to change. Faculty must feel ownership in the network system and have a personal stake in its success. Smooth operation of the system requires participation and commitment.

Summary

Use of networks and network servers in the graphic arts is increasing and becoming the standard for the transfer and processing of digital information. Ability to accept customer-created digital files is a requirement for both printers and publishers. Mirroring the network server in a graphic arts laboratory prepares students for the work environment they will encounter within the printing and publishing industry. Therefore, this technology is a vital aspect of the educational process.

Educators currently using traditional methods of workflow within the classroom should introduce the concepts behind the use of a network and network server. Networks and network servers can potentially enhance or facilitate collaborative learning and ease the burden of management and organizational tasks. Students are rewarded with the understanding of digital workflow and become better prepared for the job market. Persons already using this technology should be encouraged to expand its use. Students do not need to become proficient with network software; they need to focus on using a digital workflow. It has been a positive experience for the students at Ball State University.

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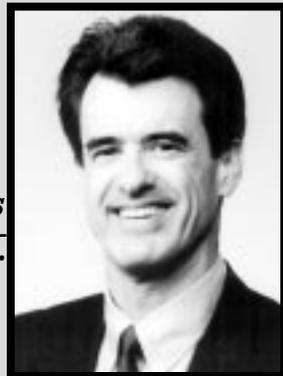
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Student Recruitment: Crisis or Opportunity?

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Whenever a group of educators get together, sooner or later the conversation turns to the subject of student recruitment. Many exclaim with dismay that their numbers are low and the outlook for future enrollment is not bright. Beacon (1982) pointed to the fact that through the seventies, many authorities bemoaned the coming crisis in higher education brought on by a decline in the number of traditional age students. Other writers have also discussed declines in student enrollment, particularly in the vocational/technology teacher education institutions (McAlister & Erekson, 1988; Oakes & Loepf, 1989; Volk, 1993; Lynch, 1994; and Weston, 1997). It has been stated that programs have declined or closed completely (Oakes & Loepf, 1989), or that there has been a major shift in college curriculum in the direction of industrial technology and away from technology education (McAlister & Erekson, 1988). On the other hand, Goff (1997) reports that university enrollments in computer science and information technology programs are beginning to increase after years of decline. She goes on to say that such increases have created a faculty crisis which is considered "just a normal swing of the pendulum" (p. 92).

Is this problem facing education a swing of the pendulum or are there other concerns which have not been examined? The problem is not unique to higher education. Teachers across the country, from high school to vocational center to post-secondary programs, are under the gun to increase class enrollments or face program closure.

Personality Type and Career Choice

John Holland proposed a theory that people are characterized by one of six personality types: Realistic, Investigative, artistic, social, enterprising or conventional (Holland 1985). According to his theory, an individual will be more comfortable living and working in surroundings that correspond to his or her type. Resulting from his research into career development, Holland developed the Self-Directed Search (SDS) as a way to determine a person's resemblance to the types (Holland 1985). The SDS places the client in a personality pattern of three primary types or subcategories. The first

type is considered the high-point or main type, while the remaining two also have an influence on the career choice of the individual. A graphic arts teacher may be a realistic/social/artistic type—basically a hands-on type of individual, but showing concern for others and artistic attributes as well.

Since Holland originally espoused his theory of personality types and environments in 1959, numerous studies have been conducted to assess the merits of his work. He stated that over 400 investigations had been conducted between the initial theory and the publication of his 1985 work. Of those studies, he concluded that the main hypotheses of the theory have been supported.

Multiple studies imply that the hexagonal model is a useful if imperfect way to organize personal and occupational data. The ordering (RIASEC) of types or occupational categories is similar even when the data, sexes and cultures vary (Holland, 1985, p. 119).

He further stated that the research had been broad-based including "large samples of children, adolescents, college students, and adults as old as 88, and both men and women" (p. 119). Research continues to support the basic tenants of the Holland personality type theory (York & Tinsley, 1986; Henry & Bardo, 1987; Gianakos & Subich, 1988; Latona, 1989; Alvi, Khan & Kirkwood, 1990; Ben-Shem & Avi-Itzhak, 1991; Jager, Neukrug & McAuliffe, 1992; Schwartz, 1992; Tracey & Rounds, 1992; Harrington, Feller & O'Shea, 1993; Ferreira & Hood, 1995; and Holland, 1996).

In a 1995 study, Dailey found that when undeclared university students were given a self-assessment instrument comparing personality type with choice of major, there was a significant degree of correspondence. Students in undeclared Academic Orientation classes at a mid-sized south central university were asked to rank their choices of personality and possible major choices according to Holland (1985) coding. Holland types were not presented on the form, but are listed below for informational purposes for the reader. Personality trait choices provided to the students are as follows:

- realistic: enjoy motor skills, genuine, mechanical, orderly, persistent, practical, shy, stable, realistic
- investigative: enjoy research, analytical, curious, independent, intellectual, introspective, mathematical, methodical, passive, precise, rational, reserved, scientific
- artistic: enjoy art, music or literature, disorderly, emotional, idealistic, imaginative, independent, introspective, intuitive, original, sensitive
- social: enjoy working with people, cooperative, friendly, generous, helpful, idealistic, insightful, kind, persuasive, responsible, social, understanding
- enterprising: acquisitive, adventurous, ambitious, argumentative, energetic, impulsive, optimistic, self-confident, talkative
- conventional: enjoy clerical or computational tasks, conscientious, efficient, orderly, persistent, practical, neat, self-controlled

Subjects were also asked to rank their first two choices from a list of majors or areas of interest arranged according to Holland code. The order presented on the form was scrambled, but is presented as follows in the same order as the above personality traits:

- realistic: agriculture, construction technology, fire and safety, horticulture, manufacturing technology
- investigative: anthropology, environmental resources, mathematics, pre-medicine, psychology, sciences, statistics, pre-engineering
- artistic: art, clothing construction & design, interior design, journalism, music, performing arts, public relations, theater arts
- social: child and family studies, corrections, education, health, nursing, occupational therapy, religion, social work, sociology, speech communications, police administration, psychology
- enterprising: broadcasting, fashion merchandising, finance, food service administration, health care administration, insurance, management, marketing, real estate, law, sales, politics
- conventional: accounting, assets protection, banking, computer information systems, computer science, economics, general business

It was discovered that the only significant comparison of choices was between first choice of both personality

type and major area of interest. Of 382 students completing the form, 40% selected social as a personality type and 35% chose the same area for a major interest. In declining order, enterprising, artistic, realistic, conventional and Investigative were first choices of the personality types. After social areas of interest for a possible major choice, students selected enterprising and conventional equally, and then investigative, artistic and realistic fields respectively (Dailey, 1995).

Replication of the Study

Would such data continue to hold up with undeclared students if the 1995 study were replicated? The present research was conducted in the same way as the 1995 study, except career presentation methods were not investigated. A letter was sent to instructors of 26 Academic Orientation classes at the same university as the previous study. Once again, classes were composed of mainly undeclared students. Instructors were requested to have the students complete the forms and return them to the researcher. Thirteen instructors returned forms—337 of the forms provided usable data. There were 129 forms returned which were deemed unusable.

Of the usable forms, 178 (53%) were completed by males, and 159 (47%) were completed by females. At the time of the survey which was early Fall of the freshman year, a majority of 249 students (74%) indicated they had not chosen a major, which was to be expected in orientation classes designed for undeclared students. As discovered in the previous study, the major personality type selected by 40% (137) of the students was social, followed by enterprising and artistic. When study participants were asked to select a major or interest area they were considering most, once again 144 (43%) students ranked social major choices high. Students were more widely divergent as to their second choices in both personality type and area of interest.

As shown in Table 1, the observed chi-square value of 120.75 for the contingency table of personality first choice versus area of interest or major first choice exceeds the critical value of 52.6, $P < .001$. Therefore, at the .001 level, $(.999 \times 225 = 52.6)$, it has been shown that there is a significant relationship between students perceived personality and their choice of interest or major. This finding parallels the previous study conducted two years earlier with similar students in undeclared Academic Orientation classes (Dailey, 1995). Also, Holland's prediction (1985) that personality type and occupational areas are strongly related has once again been substantiated.

Personality Type and Interest Choice versus Recruiting

Since it has been shown that there is a strong relationship between personality type and area of interest, how can that fact be related to recruiting students and increasing enrollments? Holland (1985) stated that since the average person knows so little about careers, almost any information would be helpful in decision making. According to Anderson, Creamer, and Cross, (1989) 50 to 70 percent of the college students change majors on campuses nationally. In light of Holland's personality/career association, his statement about career knowledge, and the changeable nature of youth, those concerned with recruiting should take note. Is it possible that recruiting should be targeted in the direction of matching the personality of the student with the occupational program?

Since most of the readers of this journal are involved

in the graphic arts, this discussion will target recruiting for that discipline. According to Holland (1985), the majority of skill levels in this particular field fall in the realistic type: those enjoying motor skills, hands-on activities, genuine, mechanical, orderly, persistent, and practical. This is not to say that these are the only personality types that may be found in the graphic arts environment, but these would most likely be the high-point code of the typing system. As previously stated, Holland typing systems classifies individuals with a three letter code determined by completing the Self Directed Search (Holland, 1985). In other words, one may be realistic/artistic/social or realistic/social/enterprising or other combinations. The point is, one could be mainly a hands-on type person, but also have interests and qualities in other areas.

According to Holland, individuals are more satisfied when they work in surroundings that fit their personality types. If that be the case, recruiting would be more fruitful if it specifically directed students for graphic arts programs to the interests of the most likely candidates—the realistic types. Instead of producing a general brochure about a graphic art program, why not direct informational pieces to the hands-on personality?

What about the research showing the majority of college students fitting into the social type? Holland (1985) found college students were more likely to identify with social types than any of the remaining types. Boyd & Cramer (1995) showed similar results from a sample of students from four colleges and universities on the east coast. Niles (1993) reported that a majority of females in his study identified with the social type, while males indicated social second to enterprising. Gianakos & Subich (1988) also reported females predominately chose social, while males were strong in investigative and conventional areas.

The dominance of the social type in student choices could possibly be explained by the fact that interest inventories are often based on preconceptions. With limited knowledge of some occupational categories, and preconceptions based only on their background, students may show interest only in familiar areas. Job titles in the social category are well known. This may explain the dominance of the social type choice.

Cell Contents: % of Row, % of Col, % of Table, Count Major Area of Interest, N=336							
	R	I	A	S	E	C	ALL
R	7	5	4	13	4	4	37
	18.92	13.51	10.81	35.14	10.81	10.81	100.00
	2.08	1.49	1.19	3.87	1.19	1.19	11.01
	7	5	4	13	4	4	37
I	1	7	0	5	0	0	13
	7.69	53.85	0	38.46	0	0	100.00
	0.30	2.08	0	1.49	0	0	3.87
	1	7	0	5	0	0	13
A	4	2	21	23	7	5	62
	6.45	3.23	33.87	37.10	11.29	8.06	100.00
	1.19	0.60	6.25	6.85	2.08	1.49	18.45
	4	2	21	23	7	5	62
S	6	11	3	78	18	17	133
	4.51	8.27	2.26	58.65	13.53	12.78	100.00
	1.79	3.27	0.89	23.21	5.36	5.06	39.58
	6	11	3	78	18	17	133
E	9	7	6	22	18	11	73
	12.33	9.59	8.22	30.14	24.66	15.07	100.00
	2.68	2.08	1.79	6.55	5.36	3.27	21.73
	9	7	6	22	18	11	73
C	2	0	3	3	2	8	18
	11.11	0	16.67	16.67	11.11	44.44	100.00
	0.60	0	0.89	0.89	0.60	2.38	5.36
	2	0	3	3	2	8	18
ALL	29	32	37	144	49	45	336
	8.63	9.52	11.01	42.86	14.58	13.39	100.00
	8.63	9.52	11.01	42.86	14.58	13.39	100.00
	29	32	37	144	49	45	336

R=Realistic, I=Investigative, A=Artistic, S=Social, E=Enterprising, C=Conventional CHISQUARE =120.758 WITH D.F. =25

Table 1: Self-reported Personality Type as Compared with Major Area of Interest according to Holland Code

Marketing Your Program

Essentially, graphic arts teachers are in the business of educating. However, teaching implies that students enroll in graphic arts classes. To attract students, programs must be mandated. According to Grove, marketing can emphasize the quality of education by forcing colleges and universities to understand and promote the things they do best (1992, p. 21). That also holds true for the secondary and post-secondary school.

An interesting approach to marketing technical programs was conducted by a Michigan community college facing declining enrollments. They realized their target market included employed adults who wished to upgrade their skills, pre-engineering students within the college who might need to fall back on technology careers, and high school students. An idea was adopted based on restaurants serving small portions of their specialties, A Taste of X City. Why not a Taste of Tech to promote technical programs? A food theme was used with a menu for the event, meal tickets to track the number of entrees, or activities students attended, and taste treats, or short hands-on activities, in the labs (Nedry, 1996).

There was a desire to be selective rather than have busloads of students wandering the building. Therefore, the event was held near the end of the day to draw those truly interested. An incentive for students to complete the entire meal for the mind, was a fanny pack and eligibility for a drawing for a school jacket. Technology enrollments increased by 6.5% the following fall, while other college enrollments fell by 2.98%. Several students who enrolled in the fall term indicated that they became interested because of what they saw during the Taste of Tech. (Nedry, 1996).

We often feel that we are in a crisis situation when we think of our enrollments, not knowing which way to turn. The Chinese write crisis with two characters—one meaning danger and the other opportunity (Beacon, 1982, p. 23). Beacon further states that opportunities will exist for those institutions willing to experiment with new ideas and keep pace with our technologically-oriented future (p. 30). He points to the fact that we will have more adults, part-time students, graduates returning for upgrading, Hispanics, blacks, women, and foreign-born students in our classrooms. He said this in 1982, and we are experiencing the truth of his prediction. Are we actively seeking those personality types that match our programs, the opportunities, or are we bemoaning the crisis of low enrollment?

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Considerations For Computer-Based Instruction

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Computer-Based Instruction (CBI)

Since the introductions of the Harvard Mark I, the German Enigma Machine, and the Electronic Numerical Integrator and Calculator (Evans, 1979), computer technology has continually advanced in the development of the personal computer that is now commonplace in many work, home, and learning environments. The availability and simplicity of computers and supporting hardware and software as tools, with seemingly unlimited potential, have propagated the increased use of computer-based instruction (CBI) in education. CBI systems can provide digitized user-controlled video, graphics, text, sound, and animation to provide learners with a consistent presentation that can be viewed as often as required (Chen, 1994-95). Prepackaged educational programs and multimedia development software have added to the attraction of using CBI in the classroom. The ability of both the educator and the learner to manipulate, control, and display information relating to learning tasks, allows for a more customized presentation of information (Rajkumar & Dawley, 1994).

Computer Applications

Applications of computers in the classroom can be broadly classified as a 1) classroom presentation system, or 2) computer and tutorial laboratory (Rajkumar & Dawley, 1994). A computer used as part of a presentation system enables the presenter to incorporate a wide variety of information such as graphics, spreadsheet, hypertext, digital video, word processing, and simulation (Pisciotta, 1992). Rajkumar & Dawley (1994) point out that this approach does not supplant transparencies, or the regular chalk board. Instead, it increases the variety of instructional methods by allowing the computer to be used in addition to the conventional modes of teaching (p. 108). Computers used in a laboratory setting is a common occurrence in education. In a computer laboratory setting, the purpose should not be to augment a lecture, but to provide hands-on training which allows students to use the computer as a tool to manipulate and solve problems relative to the learning task. The laboratory setting also

allows students to perform instructional tasks at their own pace, which can result in shortened learning time (Rajkumar & Dawley, 1994).

Computer-based instructional systems have been incorporated into the educational program of many government agencies, businesses, industries, and schools (Hannum, 1990). The application and use of CBI technology requires selection of an appropriate instructional method that is consistent with the learner and the desired learning objectives. CBI is successful because it relies on the ability of the educator to use it in a way that is more effective and efficient than other means of instruction (Croft, 1993-94). To realize learning benefits from CBI, one must identify factors that influence learning. It is not enough to present content via CBI with the expectation that the learner will benefit based only on the technology. Factors that influence learning in media studies include content, task type, and individual learner traits (Clark, 1983; Clark & Sugrue, 1989).

Learning from Media

The focus of media research has often involved studies that investigate the comparative efficacy of traditional methods of delivery versus new instructional technologies. This approach has received much criticism due to the idea that "...media are generally the inert carriers of instructional messages rather than the active ingredient in learning" (Mielke, 1964, p. 134). Clark (1983a) suggests that the focus for evaluating the efficacy of media on instructional outcomes should not be on the media type but, rather, on instructional methods, content, and the learner. Clark & Sugrue (1989) provided a summary of media research that maintains that learning which does occur from well-constructed media presentations is due to three variables—learning task type, individual learner traits, and instructional method. Therefore, it is plausible to suggest that the learning task type, learner traits, and instructional methods must be understood and properly applied before consistent success with instructional media presentations can be realized.

One dilemma many educators face when integrating technology into the classroom experience involves se-

lecting an appropriate delivery medium. A sampling of the numerous options available include transparencies, color slides, video, audio tapes, and computer-based variations of text, audio, graphics, animation, and video.

Emerging technologies, such as artificial intelligence, asynchronous computer conferencing, and interactive digital video and optical formats, provide yet another level of delivery media from which educators can select (Hannum, 1990). Software used to author CBI programs is becoming easier to use. The availability of media technologies contributes to their use and, in turn, more media is used in educational settings. While, in some cases, more may be better, it brings to light the issue of appropriateness. Employing the most appropriate media is key to achieving the desired learning outcomes. However, the selection or development of media is often based on the software features of the medium, such as trendy special effects, rather than the effects it has on learning.

Instructional Method

One advantage of CBI is the capability to present information both aurally and visually in response to the sensory capabilities of the learner. While a common practice when utilizing CBI is to respond to as many senses as possible, this approach can be detrimental to the learning process. Although there is support for such an approach, there is also conflicting evidence that suggests learners have the capacity to handle only one source of input at a time. The following is a review of research that supports both approaches to instructional sequencing.

STATIC VISUALS

Current research investigating the use of static visuals or pictures has concluded that their use does help in the processing of text (Reiber, 1990; Siribodhi, 1995). Pictures provide an actual physical description of an object, which allows the learner to easily visualize it. Pictures also increase retention (Pea, 1991). Drawings are useful when instant recognition is critical. Drawing can depict the internal structure of a component or the way the component fits together (Bogert, 1989).

Additional evidence suggests that experience plays a role in the effectiveness of visuals. Young or novice learners tend to derive greater benefits than older or more experienced learners when visuals are used (Reiber, 1990; Levie & Lentz, 1982). More experienced learners have an increased capacity to form mental

images based on previous experience (Pressley, 1977). Furthermore, the complexity of visuals can affect learner processing—learners may ignore complex or overly detailed visuals due to their inability to identify appropriate learning cues (Dwyer, 1978).

VISUAL AND VERBAL INFORMATION

When using static visuals in conjunction with text, research indicates that visuals that are congruent to the text are most helpful (Willows, 1978). Congruency refers to text that complements or relates to the visual rather than text that is not related to or presents conflicting information about the visual. Stone & Glock (1981) investigated the effects of text-only, illustrations-only, and text-with-illustrations instructional methods on the performance of second- and third-year college students building a toy cart. They concluded that the students who received the text with illustrations treatment experienced fewer errors when completing the performance task. In addition, the illustrations-only treatment group experienced fewer errors than the text-only group. This suggests that the addition of illustrations to text or the use of illustrations alone conveys spatial information more effectively than text alone.

Nugent (1982) presented an encyclopedia film to fourth, fifth, and sixth graders accompanied by visuals and print; visuals, print, and audio; visuals and audio; visuals-alone; print-alone; and audio-alone treatments. While no significant differences were found between the print-, audio-, and visual-alone conditions, the visuals with audio and the visuals with print treatments produced significantly higher recall of factual information than either the visuals or audio alone. However, the visuals plus audio treatment group had significantly higher recall than did the print plus audio group. These findings suggest that using a visual/verbal presentation can increase retention over visual alone or verbal alone presentations.

Findings from a Powell and Harris (1990) study reported that different instructional formats did not affect SCUBA-diving performance (Green & Powell, 1988). Additional findings reported by Powell & Harris (1990), consistent with their earlier study, suggest "...that psychomotor task performance is not dependent on how instructions are presented and that sex has no differential effects on the psychomotor task of marble placement" (p. 1187). These results may be attributed to the performance task. The task (marble placement) was relatively simple (moving a marble from one location to another) and may not have provided an adequate level of discrimination. Success or

failure by the subjects was not based on the psychomotor performance but on the ability to remember the location to place the marble.

Results from a study by Henke (1997) suggests that psychomotor instruction presented via a visual/verbal format significantly increased performance over presentations of the same information using a visual-only or a verbal-only delivery. Instructions for a complex technical performance task were delivered via visual only, verbal-only, and visual/verbal combined CBI. Further results indicated that gender did not influence performance within or between delivery formats.

In a study investigating workers' performance, Kammann (1975) found performance increased when operating instructions for a complex phone system were presented in flow chart form rather than paragraph form. These findings suggest that the complexity of the task is linked to the learning benefits of visuals over text.

VIDEO AND ANIMATION

The attributes of effective animation for learning are linked to visualization, motion, and trajectory (Klein, 1987). A learning task that requires visualization, motion, and trajectory for completion would benefit from animation that contains those qualities (Childless, 1995). Kuzmas (1991) review of media research indicates that most studies examining the effects of video-alone, audio-alone, and video with audio reported increased recall with the combined video and audio condition. Baggett (1979) presented subjects a story in a video or audio condition and immediately tested recall by requiring the subjects to write a summary of the story. Findings indicated that there was no significant difference between the video or audio condition immediately following the presentation. However, testing one week later indicated that the subjects receiving the video treatment provided a more complete story summary. This suggests that, when time is a factor between instruction and performance, video increases more effective recall than audio.

VISUAL AND VERBAL SEQUENCE

Attempts to determine if the order of presentation of visual and verbal material affect performance have yielded inconsistent results (Rieber, 1990). A study by Noonan and Dwyer (1993) concluded that college-level learners benefited regardless of the visual or verbal sequence when presented identical content that focused on the physiology and functions of the human heart. The researchers attributed the results to the experiential level of the subjects and their ability to adapt

to varied sequencing. Studies by Childress (1995) and Mayer and Anderson (1991) also concluded that the order of presentation of verbal and visual information did not produce significant differences in recall performance. Childress (1995) concluded that "...the presentation order of the material may not be as important as the content of the presentation in which verbal information is presented" (p. 71).

LEARNER CONTROL

When developing or using media for instructional tasks, one must consider the amount of freedom learners have in their interaction with the instructional presentation. The design feature of control is addressed in the development of media and can be a learner controlled (nonlinear) or programmed controlled (linear) approach. Nonlinear CBI programming allows the user to make decisions, to exercise control, and to assume some amount of responsibility in interacting with the instruction (Santiago & Okey, 1992). The opposite is a linear approach that requires the learner to progress, via one route, through a predetermined structure of content and is referred to as program control (Reeves, 1993).

An individual's ability to control the path, scope, and pace of instruction is the basis of the learner control strategy (Wicklein, 1986, p. 15). A proposed benefit of a high level of learner control is that it requires the learner to become actively involved in the instruction because the learner determines the depth and order in which information is accessed. Additionally, students may determine their own pace of instruction, taking time to review by engaging in drill and practice, or by reinforcing concepts and facts pertaining to the instruction (Farrell, 1991). In a study in which students were allowed to determine the amount of practice within a CBI program, Fredericks (1976) reported a significant savings in instructional time compared to a program controlled presentation of the same material.

Allowing the students the opportunity to make decisions regarding their interaction with CBI is the major premise of a learner-controlled approach because the learners are more likely to know what information they are missing (Fishbein, Van Leeuwen, & Langmeyer, 1992). However, the effectiveness of learner control has not been optimized due to difficulties on the part of the learners to make good decisions (Santiago & Okey, 1992, p. 47).

Programmed control of instructional sequencing is a feature that is designed into the instruction that limits the students ability to make navigation sequence decisions. The developer structures the program in a

linear or sequential manner that requires the learner to progress through a predetermined sequence of information and evaluation.

While support can be found for either a linear or nonlinear approach to programming, Jacobs (1992) provides the following view of the issue:

Some empirical research, beginning with a classic experiment by Pask and Scott (Pask, 1972), has shown that learners will choose their own best learning strategies if conditions are well planned in advance. However, a mounting body of evidence suggest that learners generally tend not to choose wisely when confronted with learner-controlled system (Jonassen, 1990). In any case, as Joseph Jaynes has pointed out, most learners "have little time and less interest in exploration: they want to be led" (Jaynes, 1989).

From this perspective it would be plausible to suggest that there are other factors that influence the efficacy of a linear or non-linear programming approach on learning. Factors such as those mentioned in regards to media studies including content and task type, individual learner traits (Clark, 1983; Clark & Sugrue, 1989), and the level of learner control provided.

Students and Teachers Are Ready For CBI

According to Calder (1964), a live demonstration is more effective than a television presentation of the same material. Carl (1975) reported that a live class presentation is more effective than a video tape presentation for teaching a selected psychomotor skill. However, society is more technologically advanced than 25 years ago. According to Bell (1989), innovations, such as the change from all mechanical, electrical, and electromechanical systems to electronic systems, miniaturization, digitization, and software, underlie what he calls the third technological revolution. Current advanced technologies provide educators with a unique opportunity to develop more effective instruction in response to the increasing dynamic needs of learners.

Because of the ubiquitous nature of today's technology, students are accustomed to interacting with computer-generated mediums and learning from electronic and digital formats such as television and CBI. Teachers and trainers have experienced the transition from blackboards to overhead projectors to computers and are interested and intrigued by the variety and potential of instructional technologies. The general public, including elementary, secondary, and college-

level students, view technology, such as the computer, as the norm and expect innovations such as CBI to be a part of the educational process (Levinson, 1988).

Summary

The dynamic capabilities of technology allow for the presentation of instructional tasks in a variety of formats and with a variety of instructional strategies. The potential of technology, combined with the availability of computer systems, has resulted in an increased use of computers for teaching and learning in education. New technologies, such as the microcomputer as an instructional tool, are providing teachers and learners with the opportunity to explore alternative ways to learn (Hansen, 1995). If these new technologies are to become an effective component of the teaching-learning environment, educators and media developers must have access to research-based information that will guide them in selecting and developing appropriate media and instructional applications. Cruickshank (1990) states by knowing the research on what constitutes the most effective educational practices, teachers can evaluate their own practices and perhaps modify them (p. 63).

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Pollution Prevention: Opportunities for Academia and Industry

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Introduction

During the last two decades, the seriousness of environmental problems has become widely recognized. The attention given to environmental degradation resulted in new and more complex environmental regulations and citizen action. In response, industry has made steady progress toward protecting humans and the environment from the release of toxic waste and other hazardous substances. Foremost in the evolution of methods to reduce the creation and exposure to waste is pollution prevention.

The adoption of the Pollution Prevention Act of 1990 provided manufacturing facilities with the opportunity to critically evaluate manufacturing processes and technology, production efficiency, product quality, worker health and safety, liability costs, and waste disposal costs (IDEM, 1993). The introduction of pollution prevention has the potential to impact corporate America's bottom line. The U.S. Environmental Protection Agency has a number of projects which have provided cost effective methods to develop attainable goals related to environmental stewardship. The simple act of reducing generated waste results in unexpected savings, reduced waste disposal costs, and reduced costs of raw materials. Pollution prevention efforts made by manufacturers are likely to attract the attention of local citizens, government, and other groups. Often, constructive partnerships are formed to create environmental goals and integrative tools to solve environmental problems. The benefits of pollution prevention should be shared by manufacturers and the community alike.

Pollution Prevention (P2)

No single mechanism can be expected to become an environmental panacea. The complexities of consumerism, market economies, and manufacturing processes create environmental challenges which require multi-media approaches toward their solutions. Pollution prevention (P2) may provide cost effective solutions to environmental problems while encouraging process and technological innovations.

The Pollution Prevention Act of 1990 directs the U.S. Environmental Protection Agency (EPA) to integrate P2 into all regulatory programs. The bill (S.585) implements into national policy a program to reduce or eliminate the production of waste at its source when possible. The EPA was given sweeping authority to, "undertake a multi-media program of information collection, technology transfer, and financial assistance to implement this policy and to promote the use of source reduction techniques" (U.S. Senate Reports, 1990).

Pollution prevention emphasizes a multi-media approach to ensure that pollution is eliminated, not transferred from one environmental medium to another. P2 is best used as a means to reduce pollution at its source rather than controlling it after any has been generated. The term "source reduction" is synonymous with "pollution prevention." The end result is the same; the voluntary reduction of hazardous and toxic waste created during manufacturing processes. Pollution Prevention is defined as:

... any practice, including equipment or technology or technology modifications, process or procedure modifications, reformulations or design of products, substitution of raw materials, and improvements in housekeeping, maintenance, training or inventory control, which reduces the amount of hazardous substances, pollutant, or contaminant entering the waste stream or otherwise released into the environment, including fugitive emissions, prior to recycling, treatment or disposal. (U.S. Congress. Senate 1990, 4-5)

The goals of this legislation are specific. The EPA has been charged with the task of providing information which is clear and emphasizes the importance of pollution prevention to manufacturers. Additionally, EPA reports to Congress on its progress in the areas of technical assistance, research, education, services rendered to facilitate pollution prevention strategies by manufacturers, creation of standards to measure source reduction, the development of goals and milestones to assist

the implementation of the Pollution Prevention Act, and, but not limited to, establishing recognition programs for successful P2 programs (U.S. Senate Reports, 1990).

Pollution prevention is presented to industries as an option, not a mandatory regulation. In many cases, waste generating industries work voluntarily with the EPA or a state-supported pollution prevention technical assistance center. The benefit of this collaboration is a better working relationship between industry and regulatory agencies and the development of long-range waste minimization programs. Traditional end-of-pipe waste management is significantly less desirable than waste reduction at its source. However, end-of-pipe treatment, the treatment of pollution after it has been created in the manufacturing facility, continues as some manufacturers attempt to manage or control waste from production processes. Hirschhorn and Oldenburg (1991) observed, "The end of pipe system is literally clogged, backing up, and threatening the global and local health, environment, and welfare. People have literally treated the Earth as a toilet, and it is rebelling" (p. 27). Through the efforts of the EPA and far-sighted industrial leaders whose P2 successes can be duplicated, the need for end-of-pipe management will become obsolete. Buchholz (1998) noted, "that business must consider new forms of organizational structures and processes that will enable it to respond to a changing environment in an evermore responsible fashion . . . Business must now recognize the environment as being a major factor in decision making" (p. 365). Business and industry's acceptance of P2 is one step toward environmental responsibility. When the environmental impacts of manufacturing processes and other operations are clearly understood, the choice of environmental responsibility makes greater sense. Overall, dealing with strict regulations, expenses related to waste management and disposal, liability, and annual reporting of hazardous and toxic materials releases are far more costly and restrictive than adopting pollution prevention strategies.

Steps Toward Pollution Prevention

Adopted P2 programs are pro-active, participative, and voluntary. Developing the P2 program should not be considered a single episode in the life of an organization, but as an on-going process. Fundamental to the process is the creation of attainable goals and benchmarks. Goals and benchmarks can be used to measure progress and provide structure to the P2 program. It is possible that other pollution prevention opportunities may arise during the initial P2 program. The best results occur when there is commitment from management and participation by all members of the workforce.

It is essential to recognize that P2 practices will vary from site to site. The scope and scale of P2 programs depend on management components and process assessment components (IDEM, 1994). However, P2 strategies must be developed to provide the most economically feasible practices to reduce or eliminate waste.

P2 activities in which industries often participate, with the assistance of the state Office of Pollution Prevention and Technical Assistance (OPPTA), are as follows: 1) analyzing process streams for hazardous chemicals which produce hazardous waste or toxic releases; 2) estimating the potential for waste reduction; 3) developing a cost/benefit analysis for recommended P2 strategy implementation; 4) investigating the feasibility of raw material and/or process changes; 5) suggesting implementation schedules for selected P2 strategies; and 6) evaluating the results of these changes (McLaughlin, 1995).

The first step to implementing P2 is often self-assessment. The owner or plant manager might begin the process by performing a "plant-walk-through." By observing the manufacturing/production process, talking with employees, and discussing problems, many opportunities of all sizes will become apparent. Pollution prevention experts in Indiana encourage participating industries to begin the P2 process by implementing techniques which eliminate the "low hanging fruit." Normally, these are problem areas which do not require a great amount of capital to fix or change. Industries adopting such strategies report this method often lends itself to immediate and tangible successes. Strategies which yield one small success after another are important to the creation of a culture of P2 opportunity awareness within the manufacturing operation. The input of data by production specialists, line workers, and other personnel should not be ignored. In many cases, it is the people working with the process, materials, and equipment daily who know it best.

There are five widely accepted techniques which are considered in pollution prevention strategy development. These techniques will increase the magnitude of P2 implementation. Each technique is intended to protect resources, reduce waste generated, and increase production efficiency. Industries are encouraged to adopt any of the five techniques and may even combine them to gain greater pollution prevention potential. The five techniques are:

- input change replace hazardous/toxic materials,
- production reformulation change an existing end product to reduce the need for toxic products,
- production process redesign upgrading, renovating or modernizing production equipment,

- operational improvement improved housekeeping, record keeping, employee training, and quality control and,
- in-process recycling use of closed-loop systems (IDEM, 1993).

These five strategies promote continuous improvement in the processes used to manufacture goods and also in the people who are employed to produce those products. Use of the five P2 techniques creates an ongoing challenge to industries to become more aware of production methods and the use of resources. Progress can be achieved while new and innovative improvements are developed. However, with each development there must be a continuous effort to improve the system or product to minimize waste to its lowest level.

Industries have been challenged on the local and global levels to reduce the volume of waste produced annually. Most notably, many nations have agreed to the concepts found in Agenda 21. Agenda 21, the charter signed at the Earth Summit in Rio de Janeiro, is a comprehensive attempt to create environmental awareness and protection of the natural environment. Central to the mission and goals of Agenda 21 is the creation of an environmentally enlightened global population. Almost every aspect of human endeavor is recognized in the charter for its impact on the natural environment. In one section, Agenda 21 reminds us that:

All phases of industrialization must be examined and reoriented to emphasize optimal resource use. Current methods of production must be altered to require greater efficiency. Some progress has been achieved in making energy and raw material use more efficient through adoption of environmentally sound technologies and recycling. These advances should be continued and expanded. (Sitarz, (Ed.) 1993 p. 40)

Certainly, the pollution prevention initiative is one approach to meet this challenge.

Opportunities for Academia and the Printing Industry

Noyes (1993) summarized the barriers to pollution prevention. He noted the National Academy of Engineers reported that U.S. basic research is still unsurpassed. Our pool of technical talent is unmatched, and the scale of technical creativity is enormous. However, despite those accolades, four

barriers to pollution prevention were noted.

Not surprisingly, the number one barrier to establishing successful P2 programs was:

Underdeveloped Relationships Between Industry and Academia—evidence suggests that academia could better emphasize pollution prevention in providing graduates with requested skills for industry (Noyes, p. 5).

Noyes also pointed out management often ignores the needs of employees. The underdevelopment of workforce potential was identified as an overt barrier to adoption of P2 programs. "Inadequate workforce organization, training, and participation hinders prevention, ranging from shop floor suggestions to the effective adoption of new techniques" (p. 5).

What needs to be done to rectify these observations? Industry and academia may begin by forming partnerships. There is diversity in the number of printing-related education programs; each provides graduates with the skills needed to become employed in the printing industry. However, many printing education and preparation programs attempt to train students with little input or support from industry. The printing industry, for its part, must provide information and experiences to these programs. Printing practices incorporated into university programs should accurately reflect current production methods, technology, and management systems. P2 is a concept which is gaining acceptance in the printing industry. Therefore, it must be addressed by academia. This sort of activity is paramount to the development of well-trained employees. The demands of a global economy make it necessary for the printing industry to remain competitive by establishing a well-trained workforce and continuing to create innovative, clean technologies. The challenge to universities and the printing industry is to develop new ways to create efficient and realistic methods to train students who plan on entering the printing field, to share available technical resources, and to create closer collaboration. Clayton and Radcliffe (1993) suggested that education should not be confined to schools and universities. "A more applied approach might be appropriate in the business and industrial sectors. One essential task would be to develop a wider concept of social and environmental responsibility" (p. 237).

There are many aspects of the printing industry which provide the setting for close collaboration between industry and academia. Educating students and employees about P2 opportunities requires the use

of cross-disciplinary skills. Consider the printing laboratory and the printing courses offered by universities; with the input of the printing industry, course offerings can actually become a microcosm of the industry itself. Such collaboration brings together leaders and production specialists from the printing industry with printing program faculty. Industry may be able to impart its priorities and some of its problems to faculty and students. Realistic problems can enhance students' education while providing real world experiences.

Perhaps the solution to Noyes revelations is to create realistic situations in the facilities where people are trained for employment in the printing industry. Investigating pollution prevention issues, such as the release of volatile organic compounds (VOCs), solvent choice, solvent handling and disposal, appropriate use of selected solvents, housekeeping and maintenance, rag use and disposal, and raising awareness of facility personnel, are appropriate in both the academic arena and the industrial setting. Since these problems occur in both industrial facilities and in printing education facilities, it might be wise to make students aware of the P2 options used to eliminate these obstacles to waste reduction. A collaborative effort to confront these issues may take place in a classroom with ample opportunities to visit printing facilities on-site.

The issue of volatile organic compounds is one plaguing the printing industry. Many of the compounds and chemicals used in printing contain VOCs. The challenge or pollution prevention opportunity is to identify products which release VOCs into the atmosphere. Another option is to create an inventory system which can be used to keep track of the quantities of VOC-laden materials used during any given shift or specific job. With enough data, VOC release can be controlled per job, or shift on a daily or monthly basis.

Most VOC reduction programs attempt to reduce the emissions caused by the use of solvent, ink, and cleaning solvent. It is extremely beneficial to begin any P2 program intending to reduce VOCs by identifying those chemicals which contain high VOC concentrations. It is also significant to record where the use of these materials takes place. Every effort should be made to replace or reduce these chemicals. Careful consideration of how solvents and other materials containing VOCs are used will facilitate reduction. This sort of scrutiny will assist facilities in adoption of production processes that minimize solvent use. It is also a step toward developing training/awareness programs to ensure chemicals are used at a reduced but efficient quantity.

Many solvent companies have reformulated their products with the intent of reducing VOCs. Low VOC solvents need testing to prove their value. What bet-

ter opportunity for students to become involved in a realistic problem, than to participate in research that identifies environmentally friendly products?

Future employees (students) and printing plant personnel should be educated in the importance of maintenance and good housekeeping. Simply put, if safe and rigid standards are applied during training, they will transfer to the work place. It is here that university programs can make a huge impact on the development of P2 practices. It should never be taken for granted that students understand the nature and composition of the materials they handle. We must be extremely overt in explaining the proper handling, use, and disposal of all materials related to printing. Students and employees should be made familiar with MSDS forms. Not only is this information important to the safety of the person handling the materials, but it also protects the health and safety of those who may come into contact with printing chemistry and other materials.

Good housekeeping and maintenance practices can reduce or eliminate waste resulting from defective equipment and improper handling of materials. Solvents must be handled and stored properly to avoid cross-contamination and spoilage. By making specific policies regarding the use of solvents and other chemicals, facilities can control the amount of waste generated (IWMRC, 1997). These policies must become part of all training programs. They should be conveniently available by posting them in proximity to the area where they are used. The EPA (1990) suggests employees have limited access to solvent in order to reduce exposure and waste.

Other housekeeping practices which assist in waste reduction and reduced emissions concern themselves with reducing the need to clean. Working more efficiently with an eye toward reducing waste involves everyone who participates in the printing process. The use of low VOC cleaning products has become an acceptable practice. Although they may take longer to dry, these solvents have found a place in this industry. Controlling emissions can be achieved by placing solvents and mops for clean-up in approved containers. In many cases, solvents are placed in cans without lids because they make easier access. The results are increased emissions, spoilage, and cross-contamination. The use of plunger-type containers is accepted best practice. These simple devices reduce emissions, prevent spoilage, and eliminate cross-contamination.

Maintaining equipment and guards is an effective means to reduce waste. However, this strategy must have the commitment of management and employees. Regular scheduling of maintenance and job management can increase the efficiency of personnel and equipment. The

printing area must be clean and orderly. All spills and leaks should be cleaned up immediately. These practices should be adopted by industry, but students must be made aware of their existence if good housekeeping and maintenance are to pervade the industry.

Successful pollution prevention programs can only be achieved through education and training. Hard work, sharing information, holding a common vision, and communication are the essential elements. Increasing the awareness of the benefits of P2 is the best method to inspire active participation in the program. Schell (1997) encourages setting goals which are understandable, clearly defined, and obtainable. "They should be achievable through positive actions of employees or by actual business process changes . . . Setting goals encourages employees to change their work habits and become proactive" (p. 22). Management should be a very visible supporter of any P2 programs initiated within the company. Management needs to seek out and create channels for employee input for pollution prevention opportunities. When employees become actively engaged in developing P2 programs, they often provide the most creative approaches to pollution prevention. At its best, this approach creates employee involvement and ownership of the P2 program. The Great Printers Project (1994) suggests that everyone with ties to printing should:

Seek continuous environmental improvement through periodic assessments of operations, materials, and products, and by drawing on information and ideas from employees, print buyers, suppliers and neighbors (p. 17).

Employee's input ought to be regarded very highly. In many cases it is their actions which create a successful P2 program. They should be kept informed of all P2 developments and information. If management and employees identify reasonable P2 goals, a number of actions will be necessary to assure success. First, formal written policy will need to be accepted. Establishing environmental goals demonstrates commitment to pollution prevention. The preparation of new procedures for the use of materials and equipment, and materials handling follows. Adopting new procedures with the assistance of employee input provides a democratic system to approach P2 opportunities. Finally, training with regard to new housekeeping, processing, safety, materials handling, and disposal must be provided to all employees. EPA (1992) *Facility Pollution Prevention Guide* provides numerous strategies to create P2 teams within the manufacturing facility.

As progress is made, employees, production lines, and printing areas should be rewarded for their contri-

butions to the P2 program. Employees should have the program goals, incentives for good practice, and penalties for poor performance communicated to them regularly. Whatever approach to a P2 opportunity is chosen, all employees need to be made aware of the practices which will be initiated to meet the reduction goals.

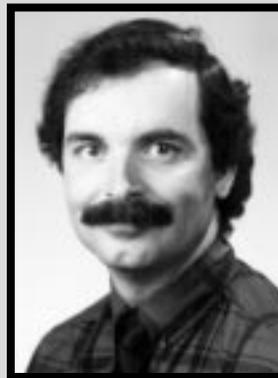
Conclusion

Much of the previous discussion is related to manufacturing facilities. As pollution prevention permeates the printing industry, a new generation of employees—those who are technically and environmentally skilled—will be required to enter this field. Manufacturers must share successes with each other and universities where future employees are trained. The best practices should be available to all interested parties. However, printing education programs must have an opportunity to model these outstanding pollution prevention practices. The success of pollution prevention requires individuals to solve problems creatively, using new ways of thinking and collaborating. Academia must provide those experiences to students who wish to enter the new age of environmentally responsible printing.

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Virtual Reality Movies: A State of the Art Report and Tutorial

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Many printers and publishers are now producing content for the Internet or CD-ROM, either as a supplement to existing printed materials or as purely electronic documents. Incorporating visual multimedia into electronic documents has become an important value-added resource that helps printers remain competitive. Visual production value has become a competitive expectation.

One media with great potential for effective visual delivery of material is the digital movie. Traditional digital movies have the disadvantage of slowing down access to web pages because of the large amounts of data that comprise the movie file. Technologies such as "streaming" the movie have helped reduce this access time by starting to play a movie before the whole file is downloaded from the Internet. Streaming has the disadvantage of putting severe limits on the size capability of the movie. Movies that are streamed usually are no larger than one postage stamp and last only a few seconds. This major limitation has forced users to download larger movie files and play them with a movie player utility. These extra steps will not be taken by the typical consumers of advertising on the Internet.

The limitations of the traditional movie format on the Internet will disappear in the future as the capability of information transmission increases through the use of DSL, ISDN, and/or cable modem connections to the Internet. However, many industry observers caution that this change will take much longer to adopt than the increases in speed present users of the Internet have experienced over the past few years. Recent increases in speed were generally due to the development of faster modems and data compression protocols for use over standard phone lines. Future massive upgrades in speed will depend on upgrading infrastructure, as in the phone lines or cable TV systems themselves. This will be a slow process.

The capability of the CD-ROM format to handle the playback of digital movies is much less a problem when compared with the capability of the Internet. This is especially true when considering the new DVD (Digital Versatile Disk) format, which was designed around the almost universal MPEG-2 (Motion Pictures Expert Group) standard. The speed of industry stan-

dard CD-ROM's of the recent past (1X to 6X speed), generally posed problems with the clean and uninterrupted playback of movie clips without carefully optimizing the movie for playback. The current fast CD-ROM drives (12X to 32X) are capable of very smooth movie playback. The short term technical capability of the CD-ROM format to handle movies is more promising than the Internet, but it is unfortunate that the business potential of the CD-ROM is considered less promising. Production budgets for CD-ROMs that were produced when the format was new, such as for the Encarta encyclopedia, matched those of an average Hollywood movie. With the exception of the niche game market, budgets of educational and general interest CD-ROM titles match those of small industrial training films. Businesses are now investing more to have an Internet presence than for a company promotional CD-ROM for direct mailing.

If the Internet is limited in its current ability to handle movies and the CD-ROM format is not as popular, what is the answer to deliver visual content? In 1995, Apple introduced "QTVR" (Quicktime Virtual Reality) as a technology that had the potential to solve this problem. QTVR is a cross platform (PC and Macintosh) navigat-



Figure 1. Users of a QTVR movie can change their view of the scene by clicking and dragging in the desired direction. An arrow in the QTVR window will indicate the capability to move in a particular direction and a hand will allow the viewer to change the angle of view within the window. Magnification is also possible as indicated by magnifying glass icon.

able movie in which viewers can interactively change their view of a scene in a window (Figure 1). By clicking and dragging a mouse on a QTVR movie, the viewer can navigate around the visual scene at will. QTVR movies have been getting quite a bit of attention from web developers since their invention because QTVR movies place much less strain on the limited data transfer capabilities of the Internet. QTVR was also recently approved (January, 1998) as part of the new MPEG-4 standard by the Motion Pictures Experts Group (MPEG) arm of the International Standards Committee (ISO).

Comparing Traditional Digital Movies to QTVR

A traditional movie is a series of still pictures, 15-30 of them a second, and a QTVR movie is one large (360 degree viewing angle) wrap-around picture. This one large picture does not take up nearly as much space as all the individual frames of a traditional movie. The average size of a QTVR movie made for the web is small and efficient (about 175kb). A QTVR movie can be displayed on the browser window in an amount of time that is comparable to displaying an average small advertising banner. A QTVR movie is accessible directly on the page without the aid of a separate player application. In contrast, a small movie—for example a

160 × 120 pixels that is a few seconds in length—typically requires multiple megabytes to transmit. A QTVR movie also has the advantage of being more responsive to viewer input because viewers change view point real-time as the mouse is dragged around on the QTVR movie window. With a traditional digital movie, the start and stop controls are often the only input, implemented in the movie playing interface. Although frame by frame and selective playback are also possible with a digital movie, in practice these features are rarely integrated as common features of the format.

The obvious disadvantage of the QTVR movie versus the traditional digital movie is that it is a static visual record (one large still picture) in which the viewer is given the illusion of movement with the ability to change viewpoint. There is no actual movement of elements in the scene, just movement of the angle of view of a large static picture. It was just this disadvantage that was remedied in the subsequent releases of the QTVR development tools. The node is a tool that provides the QTVR developer an ability to attach a hot spot to a portion of the picture that comprises the QTVR movie. A hot spot indicates a portion of the picture that can be clicked with the mouse to reveal another attached piece of visual media, such as another QTVR movie, a traditional movie, or a still picture (Figure 2). The most commonly implemented

Public Entrance

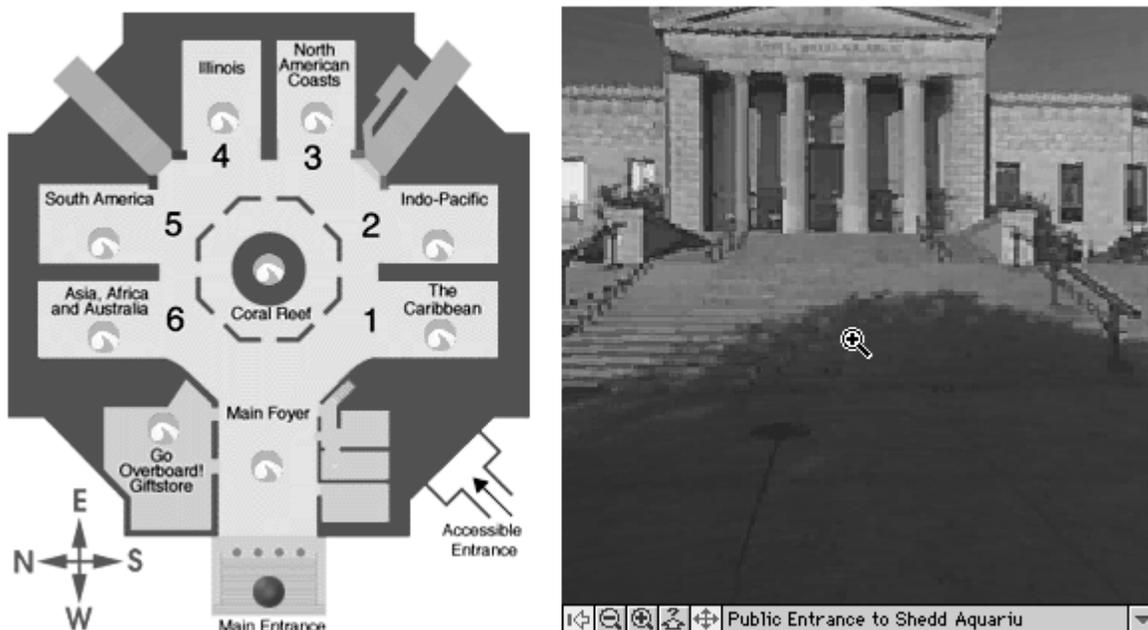


Figure 2. The node feature of QTVR makes it possible for a viewer to explore a building by traveling from room to room. In the example below, the QTVR window on the right indicates that the viewer is at the main entrance on the map on the left. If the viewer clicks on the hot spot which is the front door of the building, the QTVR window will display the main foyer. This is the first room beyond the main entrance on the map. While in any of the rooms the viewer has control of an interactive 360 degree view of the room. Proceeding this way throughout the entire building is termed a virtual tour. Both the map and QTVR view are displayed directly on the internet browser view with no need to open additional programs.

node is a hot spot on a door in a scene which when clicked opens an additional movie that takes the viewer to the next room of a building. Another use for the node is on an object in the main QTVR view which, when clicked with the mouse, displays an object movie. A QTVR object movie is a 360 degree view of an object. The viewer can change viewpoint by dragging on the window with the mouse (Figure 3).



Figure 3. In a QTVR object movie, viewers can rotate their angles of view of an object (such as this model of a shark) by clicking and dragging the mouse. This gives the illusion that the viewer has picked up an object and is rotating it.

There are several steps required to completing a virtual reality panorama or object. The following sections will provide a basic description of the production process. Subsequently, more detailed reviews and tutorials of the software available for VR authoring will be presented.

Summary of the QTVR Production Process

IMAGE CAPTURING

Images can be created for a QTVR movie using either digital or analog traditional photography.

When using a traditional film camera a wide angle lens is recommended (28 mm or wider). Use of a wide angle lens requires fewer photos to complete the 360 degree panorama picture.

To further optimize the angle of view of a panorama photograph, the camera needs to be placed vertically on the tripod with a VR head as the rotation point. Two companies currently make virtual reality tripod heads: Kaiden (Figure 4) and PeaceRiver Studios. These specialty heads provide indexed degree movements of the camera rotation, which allows for exact increments between photographs, and leveling of the camera on a horizontal axis (Figure 5). Use of these special heads is impor-



Figure 4. Below is a tripod head specifically designed for creating QTVR Panoramas. The camera is suspended exactly over the point of rotation. The camera is rotated and 15-30 separate overlapping pictures are taken to create one panorama.

tant to the quality of the finished photo because 30–50% overlap of each image is required to provide good stitching and smooth panoramas. If the capturing device is not level or incremented correctly, additional time will be required to manually adjust the photos during the stitching process. It is also possible to make a VR tripod head out of wood if the tools and time are available.

DIGITIZING THE IMAGES

If a digital camera is used to capture the photos, digitization has already been done—the images are simply downloaded into the computer. This is the advantage of using a digital camera. Film is used for many CD-ROM projects, especially when file size is not as big a concern as with the Internet or when image resolution is very important. Traditional photography provides much higher resolution than a typical low-cost digital camera. If a project requires high quality or high resolution images, film is often the only choice to capture the images.

VIRTUAL REALITY SOFTWARE

As defined earlier, QTVR's can be both panoramas and objects, and can be authored into multiple node files. Software allows for individual images taken with a digital or traditional camera to be

imported and blended or “stitched” together. Images can be rotated and reordered and are eventually stitched into a single photo which begins and ends with the same image. Such a panoramic image is called a tile (Figure 6). This single photo is then wrapped around a cylinder to present a 360 degree image that is viewed through the QTVR movie window. Once the panorama or object VR is complete, links, known as hot spots can be incorporated into the image. Hot spots allow for linking to other panorama, object, or text files.

Review of VR Applications

Now that a summary of the QTVR authoring process has been presented, let's take a closer look at some of the software options that are currently available for creating virtual reality files.

APPLE QUICKTIME VR

Apple QuickTime VR was the first QTVR software package to be released. It is a complete authoring package for CD-ROM application of Virtual Reality technology. It can be used to link text, movies, object VR's and panorama VR's into one clickable file.

The original software package was capable of producing both panorama and object VR's, but early versions of the software required in-depth knowledge

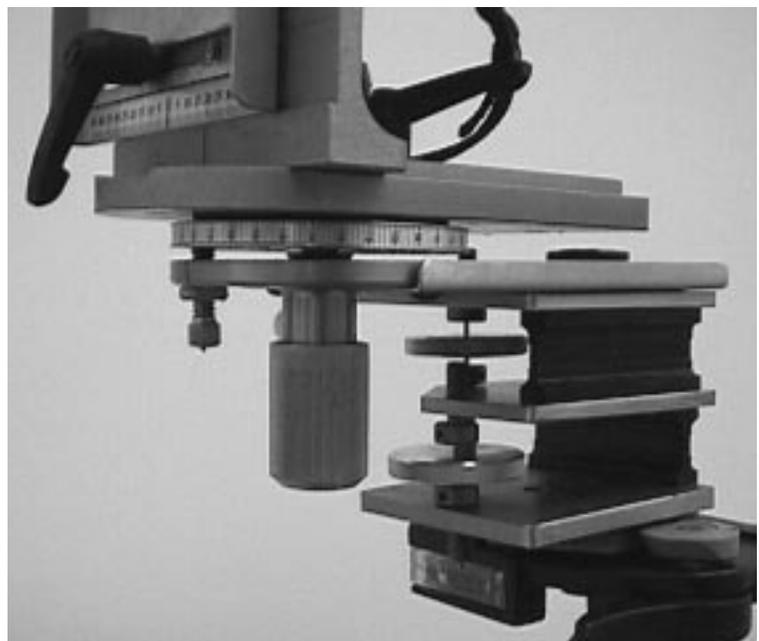


Figure 5. A VR Tripod head has an angle adjustment indicator with click stops to indicate exactly at what angle a picture should be taken.

of scripting language, which made it difficult for beginners. It was developed for use by programmers and developers and can be more difficult to master than other products currently available. The approximate cost of this software package is \$395. More information is available from <http://quicktimevr.apple.com>.

Advantages

- hot spots are easily embedded into a photograph
- a wide variety of lenses can be used
- well organized, step-by-step interface
- has the most control of any of the software packages because of its scripting option.
- very useful for CD-ROM authoring
- has its own authoring software included in the package
- different compression options for finished product

Disadvantages

- early versions required knowledge of scripting language
- high cost
- steep learning curve
- Macintosh only

NODESTER BY PANIMATION

Panimation was the first company to develop a user-friendly interface with their panorama software Nodester (Figure 7). A relatively new software development company, Panimation's mission is to develop a more robust, reliable VR tool based on QTVR. The approximate cost of Nodester is \$169. More information is available from <http://www.panimation.com>.

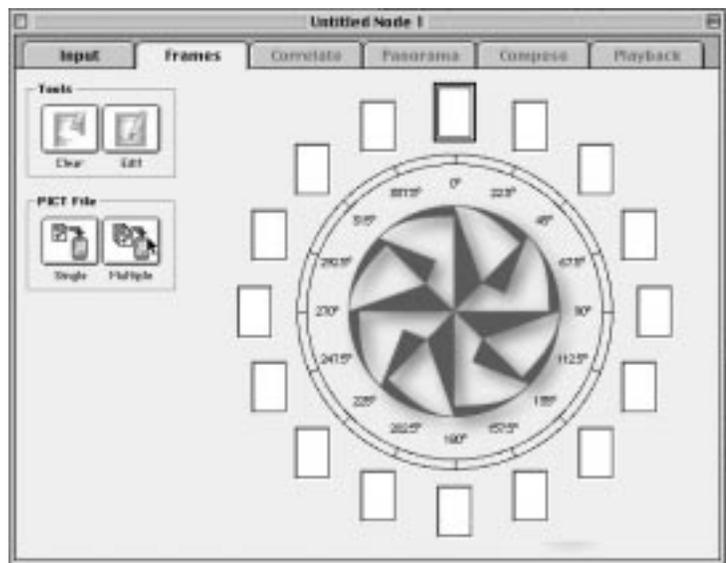


Figure 7. Nodester has a well organized user interface on which the steps for QTVR creation are referenced by tabs at the top of the window.



Figure 6. This is an intermediate step to creating the QTVR file called a tile. The tile is one long panoramic image created by stitching together the 15-30 different images captured with a camera on a VR head.

Advantages

- auto-blending—no need for stitching adjustment
- very fast
- built-in image editor can be used to clean problem areas on photos
- demonstration available for download

Disadvantages

- doesn't provide a built-in authoring platform
- depends on outside authoring package to create CD-based tours
- macintosh format only

WIDGETIZER BY PANIMATION

Widgetizer is a program designed to create object VR's. Fifteen to thirty views of one object are photographed, then Widgetizer is used to bring these together into an object VR. As illustrated by the hand in the middle of the interface in Figure 8, the subject is placed on a platform and rotated in front of the camera. Widgetizer's approximate cost is \$169. More information is available from <http://www.panimation.com>.

Advantages

- creates object VR's
- allows hot spots to be embedded into object VR
- only 6 megs of RAM needed
- allows sound files to be embedded
- demo download on web site

- straight forward interface
- supports QTVR 1.0, 2.0
- frame-based animation

Disadvantages

- not a full VR package, only capable of object VR's
- requires outside authoring tools to author a CD-ROM

PHOTOVISTA BY LIVE PICTURE

Photovista is made by Live Picture Corporation, a company that began as an image editing software development company. Live Picture has now begun to focus on virtual reality for web applications. Photovista is a cross-platform panorama VR maker. Figure 9 illustrates image strips ready for stitching in Live Picture. Live Picture's approximate cost is \$99. More information is available from <http://livepicture.com>.

Advantages:

- low cost
- dual platform
- user-friendly interface
- optimizes files for the web
- hot spot linking
- allows most variety of lenses to be used of any of the software

Disadvantages:

- no built-in authoring software for CD-ROM authoring
- panoramas only (currently Live Picture is working on object/panorama studio)

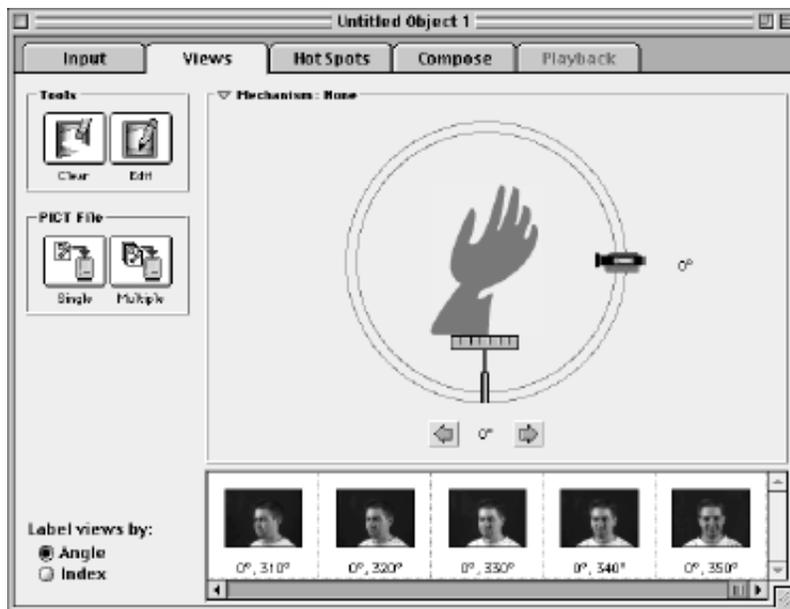


Figure 8. Widgetizer is a automated program capable of producing Object VR movies from consecutive still pictures of a rotated object.

SPIN SUITE BY PICTUREWORKS

Picture Works has a suite of programs designed to provide a VR solution. Spin PhotoObject can create object VR's. Spin Panorama can create panoramic VR's. Spin Suite is a bundle including both programs. PictureWorks has previously developed successful image-editing software. The approximate costs for Picture Work's applications are as follows: Spin PhotoObject is available for \$149.95, Spin Panorama for \$129, and both for \$279.85. More information is available from <http://pictureworks.com>.

Advantages

- simple, step-by-step process
- choice of file type for end product
- dual platform
- runs on 16 megs of RAM
- supports a variety of compression types
- offer object/panorama software separately and as suite

Disadvantages

- no CD authoring software
- requires 50 Megs of hard drive space
- no lens specification option

Virtual Reality Tutorials

Now that the advantages and examples of VR programs have been presented, the following sections will serve as a tutorial for the production of QTVR panoramas and objects. Sections will cover ConvertToMovie, Object Maker, and Panimation programs and conclude with an explanation of how to use HTML code to display VR files on the web and a reference to web sites with VR resources.

TUTORIAL 1: CREATING OBJECT VR'S

All software needed to create object VR's is available free from Apple. Virtual Reality objects are files which allow the viewer to see an object from 360 degrees horizontally and 90 degrees vertically. This is a very useful format for showcasing objects of any size or shape. The real power of object VR's is that they can be created with a minimal amount of technical equipment.

Equipment required

- camera (35mm or digital)
- tripod
- rotating platform (such as a TV stand)
- scanner (for photographs only)
- Macintosh computer
- ConvertToMovie software
- Object Maker software

Step 1: Capturing the images

A. Mark a piece of paper with approximately 36 equally-spaced lines (Figure 10). Place this sheet under the base of a rotating platform. Set up the tripod and camera facing the rotating platform.

B. Place the object to be photographed

in the center of the platform and rotate completely while checking for placement through the view finder of the camera. The object should stay in the center of the screen as it is rotated 360 degrees.

C. Check for even lighting so that the object doesn't cast any hard shadows. To achieve accuracy of movement, make a mark on one

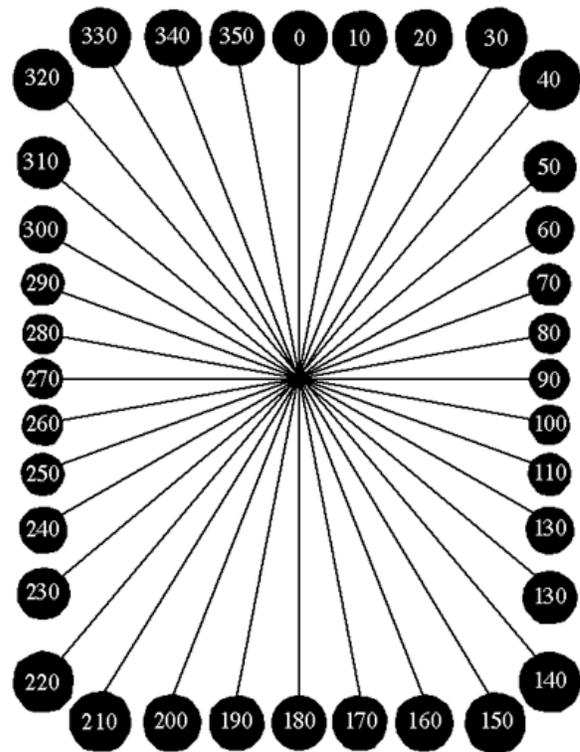


Figure 10. Angle indicator guide for QTVR photography.

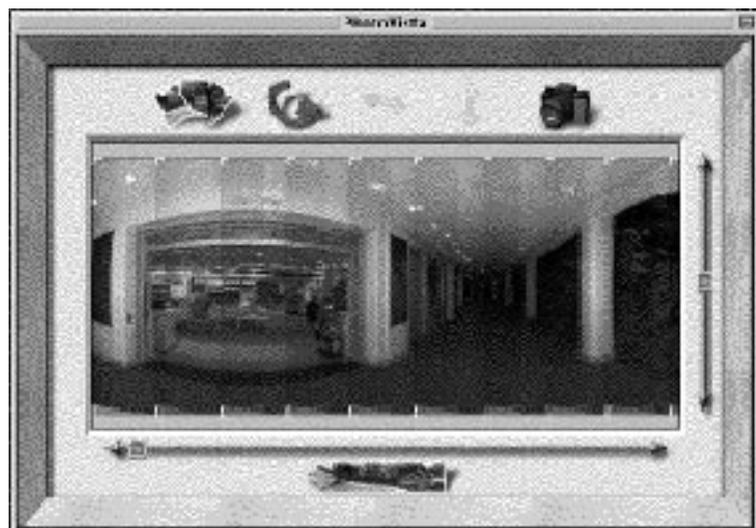


Figure 9. Photovista is an automated application designed to stitch together separate images into a panorama movie file.

side of the platform so you can check alignment of the object on the degree sheet.

D. Take 36 photographs of the object, rotating ten degrees in between each shot.

E. Download or scan the photos into the computer. Images should be saved as PICT files in sequential order. This is very important. File names have to be numerical starting at <your pict file name>.01 and ending with <your pict file name>.36.

Step 2: Converting the Images Into a QTVR Object File Using ConvertToMovie and ObjectMaker

A. Open the ConvertToMovie Program. The program is available for free download from Apple. At this point, you will be asked to choose the first PICT file of your images (Figure 11). (The sequential numbering of your files is very important here. For example, 1, if not saved as 01, would be followed by 10 instead of 2. By placing the 0 as a decimal place holder, all of the numbers will appear in sequence.) Choose the first PICT file of your VR object. Once you have found and selected this file, the same screen will appear again and prompt you to select the last file of your VR object.

B. The next screen displayed will ask you about

the format to be used to compress the movie file. The default compression is video—change this to Cinepak, because it is a better compression type for color images. Next, deselect keyframes and limit data rate. The setting of the quality slider is up to you. Fifty percent will provide good quality images. However, the file size is usually too large for use on the web. If you crop images down in size (using a program like Photoshop), you can use less compression and still have manageable file sizes. Experiment with compression types and settings to find the one which works best for your VR needs.

C. After the compression options have been set, the conversion option menu will appear (Figure 12). Flattening the movie will allow it to work on PC and Mac platforms. To reduce file size, select the cropping and scaling option. This menu will allow you to remove any unnecessary image border information or to increase the image size.

D. A screen displaying the first PICT file will appear, and then change to display the second, third, and so on, until it reaches the thirty-sixth file. Pay attention to the images as they appear to see if you might have numbered one of the pictures in the wrong order.

E. Once the program is finished converting and compressing, it will ask you to save. Label the movie file to reflect the type and amount of compression you used. This label will be helpful in discriminating the type of compression you will need to use if the resulting image quality or file size is unsatisfactory. Poor image quality can be corrected by repeating the process and adjusting the quality slide higher.

Step 3: ObjectMaker

A. ObjectMaker will take the Quicktime movie you just made and convert it into an object VR file. It doesn't get much easier than this! Simply open the program, go to File

Select the PICS, MooV, scrapbook, or first PICT file to be converted to a QuickTime movie.

PICT files should be of the form "name.#"

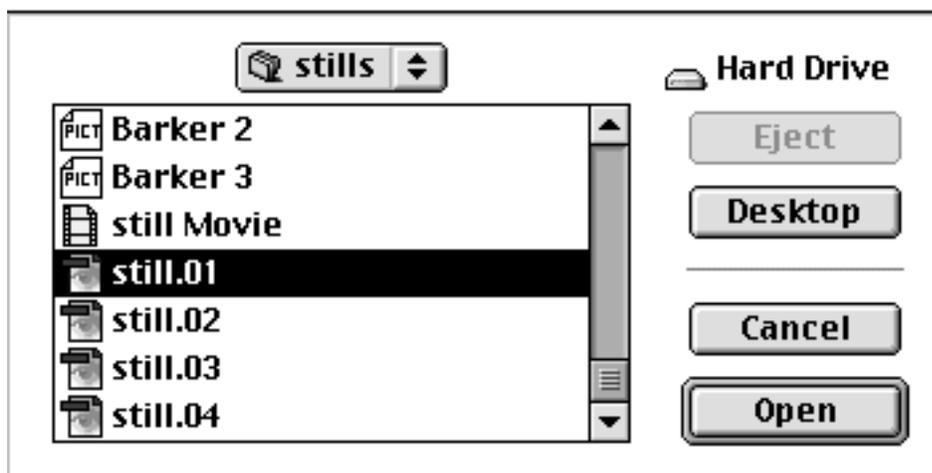


Figure 11. Selecting the first and last picture in a picture file sequence.

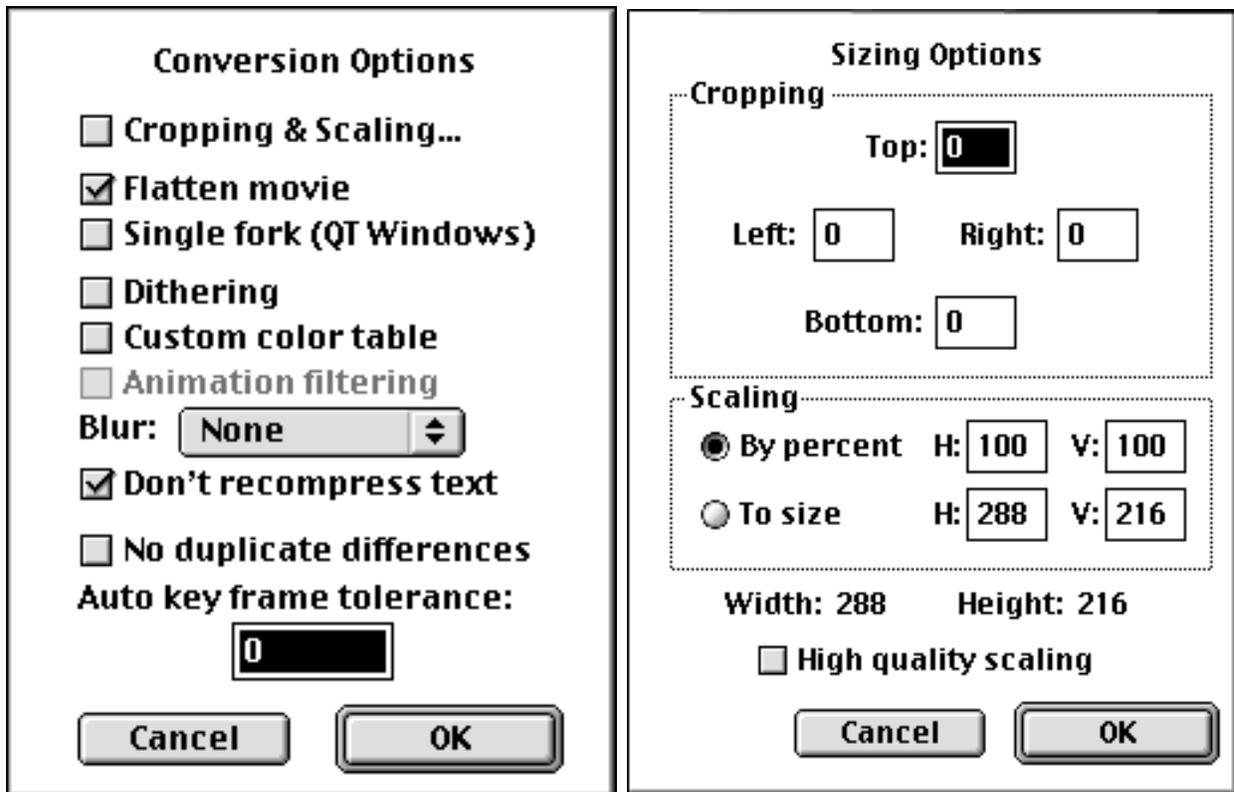


Figure 12. Conversion and sizing options menu.

and Open the movie you just made in ConvertToMovie. Once the file is open, open the Edit menu and choose Add Object Data. **B.** Configuring the add object data pop-up menu is the final step (Figure 13). If you created the VR movie file using 36 photos, just click OK at the bottom of the screen. If you used 18 pictures (capturing a image every twenty degrees) change # Of Columns to 18 and click OK. Congratulations! You have just made an object VR.

TUTORIAL 2 — CREATING PANORAMA VR'S USING NODESTER

Nodester 1.0 is a software package which creates Virtual Reality Panoramic environments. Virtual Reality panoramas are created by combining a series of pictures together which have been captured horizontally over 360 degrees. Creation of panoramas with Nodester may seem a little complex. However, once students complete the process

once, it becomes easier. Experience with computers and photography is helpful for understanding the reasoning behind some of the steps that follow. Nodester is available as a free demo download from the Internet at <http://www.panimation.com>. The demo is a 90

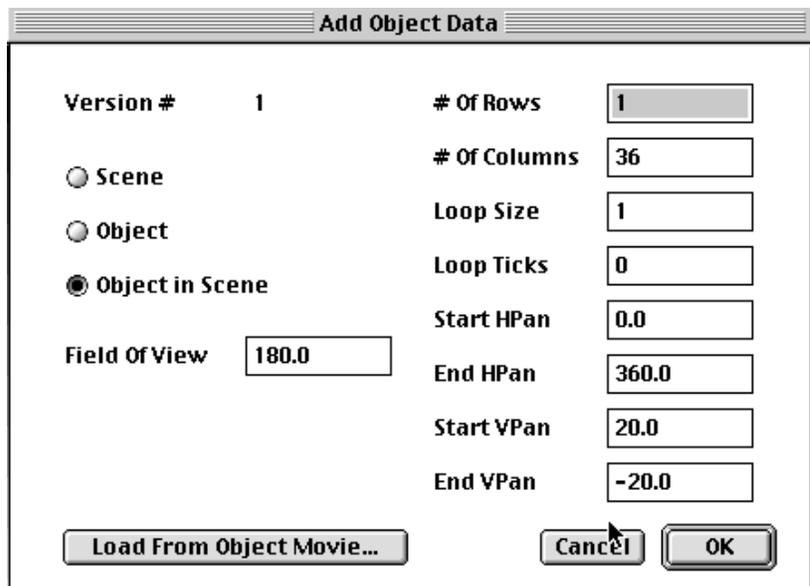


Figure 13. Input the number of images you are using in the add object data window.

percent functional copy. The free download also comes with a set of tutorials. The only difference between this demo version and the full version is that the hot spot option is disabled and each VR file will have the company's name written on the VR image when viewing.

Equipment required

- Macintosh computer with 16meg of RAM
- heavy tripod with a two-way leveling bubble on it
- camera (35mm or digital) with a wide angle lens (at least 28mm)
- L-Bracket or VR tripod head (for holding the camera in portrait position)
- lights (optional, but helpful if shooting in an interior environment, especially with digital cameras)
- laptop computer (optional, but useful for image storage if shooting a large project with a digital camera)

Step 1: Capturing the images

A. Setting up the tripod is one of the most important steps in the image-capturing process. Make sure the tripod is totally level. Overlooking this step can result in useless images that cannot be stitched correctly.

B. Mounting the camera on the tripod is the next step. An L-bracket should be used to position the camera sideways or in portrait position (Figure 14). The reason for positioning the camera this way is to obtain as much vertical image information as possible.

C. The next step is taking the pictures. All photos must have a 40 percent overlap. This means that the center of the first picture must be roughly at the edge of the second one. The number of pictures which you need to take

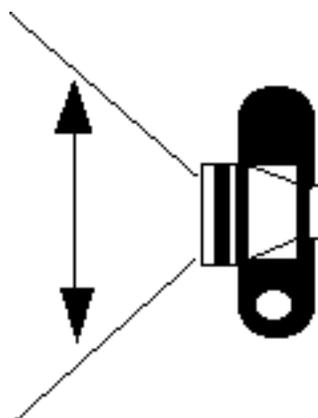


Figure 14. A camera situated in portrait position provides more vertical image information.

depends on how wide of an angle your camera lens is. A 50mm lens will require more images to be taken than a 28mm lens. The fewer pictures you need to take, the better your VR image quality will be. The biggest problem when capturing images for a VR is movement of elements in the picture between images. People are usually the biggest problem. A person walking a dog might sneak into the scene. You may not realize it until you stitch the pictures together and find an amputated arm, floating in the air, walking a headless dog. It sounds pretty funny, but wait until it happens to you.

D. Next, you must digitize the images. This is the stage when digital cameras are truly wonderful. All you have to do is plug the camera into your computer and download the images. With film cameras, have the pictures or slides developed and scan the prints on a flatbed scanner or slide scanner. Alternatively, have a Kodak Photo CD made of the images. The real power of a digital camera is its ability to preview the images while on location and recapture them if there are any problems. With a traditional film camera, it could be as long as two weeks before you discover your mistakes.

Step 2: Stitching the Images

Together Into a Panorama With Nodester

A. It is necessary that the images to be stitched be saved as PICT files. You must provide Nodester with a little information about how you captured the images. One of the nice things about the Nodester interface is that it asks you to give it the information it needs a little bit at a time. The six tabs at the top of the screen allow you to progress through the process of inputting the information about the images you wish to combine (Figure 15). You can only progress to the next step after you have given the program all the information it needs. We will start at the top and work our way to the bottom.

- "Source format" should be set to multiple frames. This tells Nodester that you wish to combine several images.
- "Acquire from" should be set to PICT file. This tells Nodester the type of format which you have saved the images in.
- "Setup" allows you to adjust the rotation of the image. If you saved all of your images on their side or upside down, you can have Nodester flip them around for

you. All images should be straight up and down in a portrait position.

- “Node sweep” tells Nodester whether or not you wish to create a 360 degree VR, or limited rotation VR. Limited rotation is useful if you are shooting a VR against a wall and don’t want the viewer to have to stare at a wall.
- “Max. Frames” allow you to reduce or increase the number of images used to create the VR. “Lens Params” allows you to input the type of lens used to capture the image. “Field of view” is directly linked to the type of lens you input. You only have to fill in one of the blanks.
- “Rectilinear” allows you to tell Nodester if you are using a special, optically corrected, lens. Rectilinear lenses are wide angled, but have no curving distortion. They are very nice if you wish to work with film. However, they are expensive. Do not select this option unless you are a shutterbug.
- “Image size” tells Nodester what size images you wish to combine into a VR file.

B. The Frames tag is where you actually input the images into Nodester (Figure 16). Importing images is done by clicking on the Multiple button. A new menu pops up to inquire where the images are. If you have numbered your images correctly, all you have to do is click add sixteen or however many you specified in the input menu. Image rotation can also be done here. Once the right images are found, click Done and the pin wheel in the frames menu will fill up with the pictures.

C. Click on the Correlate tab at the top of the screen. In this menu, you can adjust the

alignment of the images you have imported into Nodester (Figure 17). You adjust the image horizontally by clicking on the picture which is misaligned. This selects all the images to the right. The arrow keys on the screen or on the keyboard can be used to move the images around. Once you are satisfied with the alignment click on the Panorama tab.

D. The Panorama menu allows you to specify the output size of the stitched panorama PICT file (Figure 18). You can zoom in more on large images than small ones. If the destination of your VR file is the web, you should try to minimize the image size to produce a smaller, quicker loading VR file. However, if the user zooms-in on a small image, little detail will be displayed. PICT file size can be adjusted by clicking on “Set” in the “Size” window. Suggested numbers are 1248 wide by 384 high.

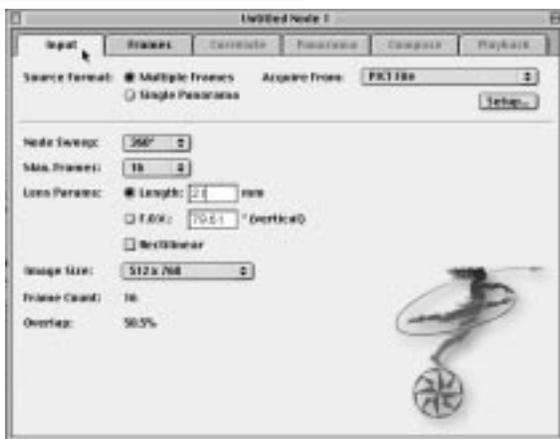


Figure 15. The input menu in Nodester:



Figure 17. The correlate menu in Nodester:

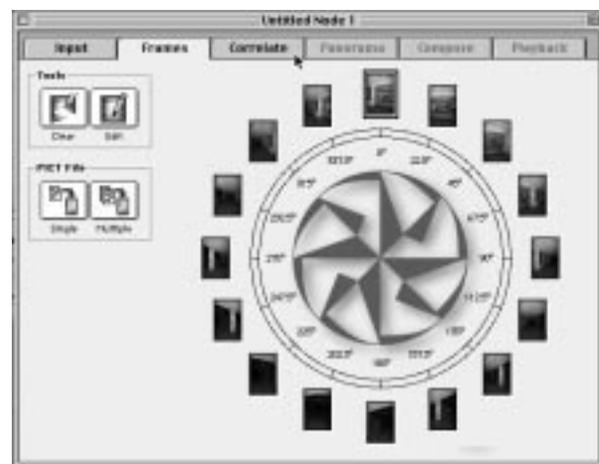


Figure 16. The frames menu in Nodester:

These proportions are both divisible by 4, which is required if the VR is to be a dual-platform VR. After these settings are entered, click Render. The images are now combined together to form one panorama PICT file. This PICT will start and end with the same image information. The Edit button allows you to change minor problems in the image. The Sharpen box runs a sharpen filter on the image. It improves blurry images but can pixelate the image.

E. The Compose menu allows you to make choices about the type of compression you want to use (Figure 19). When first creating VRs, choose Cinepak at 50 percent quality, and leave the color depth at 24 bit (millions). The file size doesn't change much for the amount of lost information with the elimination of color depth. You should experiment to find the compression and settings that work best for your needs.

The Dicing menu allows you to create a dual resolution VR file. This is one file that acts like both a high-and a low-resolution image. It is useful for multimedia applications being built for powerful or bottom-of-the-line machines. The VR file determines the capabilities of the computer and sets the display resolution automatically. Default View Angles allows you to tell Nodester what the opening view will be. Once all these settings are made, click on Compose to make the VR Quicktime file. Next, click on the Playback tab to see the VR file you just created.

F. You can view your VR file in the Playback menu. You can also change the display window size. If anything went wrong, you can simply go back to the menu where the mistake was made and input the correct settings. If you are



Figure 18. The panorama menu in Nodester.

happy with your VR, open the File menu and choose Export to save the file as a Quicktime VR file. Congratulations on making a Virtual Reality Panorama!

Step 3- Integrating QTVR Files into a Web Page

Follow the process shown in Figure 20 to integrate QTVR files into a cover page.

Conclusion

When virtual reality movies were first introduced, only the most advanced web sites and CD-ROM projects could employ them. In fact, only Macintosh programmers and developers were able to take full advantage of virtual reality movies. The original program had a steep learning curve and cost over \$1000 for the original developers package. Initially, QTVR movies were mainly part of higher-budget entertainment CD-ROM's. There are now many low cost and no-cost VR development software tools. The new software is also user-friendly and consumer oriented. VR development software packages are also now available for both PC and Macintosh platforms. VR movies are finding their way into school and institutional



Figure 19. The compose menu in Nodester.



Figure 20. Sample of HTML code used to embed a Quicktime VR file into a web page.

home pages as well as personal home pages. Another important indication that QTVR has become mainstream is the ISO's endorsement of QTVR as part of the new MPEG-4 movie standard. Previous MPEG standards have become the defacto format of the Internet such as MPEG-1 and the new DVD disk format (MPEG-2). Considering both the rapid development and explosion of QTVR content on the Internet, QTVR deserves attention among electronic publishers and graphic arts educators alike.

VR Resources on the Web

For PC virtual reality software

Smoothmove <http://www.smoothmove.com>

Photovista <http://www.livepicture.com/download/index.html>

Quicktime VR

<http://product.info.apple.com/productinfo/factsheets/quicktimevr.html>

Apple Quicktime VR homepage

<http://qtv.quicktime.apple.com/dev/devsw.html>
or <http://qtv.quicktime.apple.com/>

Other useful websites:

QuickTime VR central

<http://www.QuickTimeFAQ.org/qtv/>

The QuickTime FAQ

<http://www.QuickTimeFAQ.org/>

The QuickTime VR Web site:

<http://quicktimevr.apple.com/>

The Apple developer support web site

<http://dev.info.apple.com/>

The International QTVR Association web site:

<http://www.iqtvra.org/>



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- Present implications for this audience in the article.

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- Submit a maximum of ten typewritten, 8.5" x 11" pages (excluding figures, tables, illustrations, and photos).
- All articles MUST be submitted in electronic form.
- The text of the article is to be submitted on a 3 1/2" disk, a Zip disk, or a 44- or 88-Megabyte Syquest cartridge only. Zip or 3 1/2" disks can be either PC- or Macintosh-formatted, but Syquest cartridges can only be Macintosh-formatted.
- The text must be submitted in ASCII text OR in the Microsoft Word format. Please do NOT submit text saved in any WordPerfect format.
- Tables are to be placed in separate files from the text—DO NOT include any tables in the main text file.
- Name table files as follows: your initials tab#.ext. For example, Jose Garcia's table 1 built in Word should be named JGtab1.doc. His table 2 should be named JGtab2.doc.
- DO NOT use the table-generating feature of any word processing program to prepare tables. Use tabs ONLY.

- DO NOT embed any tables, figures, or photos in your text file.
- Call out the approximate location of all tables and figures in the text. These call-outs will be removed by the editor.
- DO NOT do any extensive formatting of text using your word processing program. Follow the APA guidelines. Underscore the names of texts or other references (these will be replaced with italics by the editor). Follow the APA guidelines with regard to formatting various levels of headings.
- Submit a hard copy of the text printed on only one side of the paper. Use one inch margins on all sides. Clearly indicate headings and their hierarchy in the text. Include the article title at the top of the second page AND as a running header. Double space all text, references, and captions. Article text should begin on the second page.
- References should not be footnoted. Cite each reference in the text using the author-date method, with the surname of authors and the year of publication:
Jones (1985)
Further work shows (Jones, 1985)...
- Follow the format in the APA style manual for your reference listing.
- List your name and address on the first page ONLY!
- Include an electronic version of your article with original submissions.

Artwork

- Submit digital and hard copies of all artwork with the first submission.
- Submit clean, crisp, camera-ready artwork in hard copy (lines and figure text MUST be solid black).
- Identify artwork on the back with your name, brief article title, and figure number. **OR**
- Electronic artwork is preferred IF you can provide EPS or TIFF files only. No PICT, BMP, WMF, or JPEG files will be accepted. Include hard copies and electronic files saved on a 3 1/2" disk, a Zip disk, or a 44- or 88-Megabyte Syquest cartridge only.

- Scan photographs at 266 ppi resolution. Photographs should be scanned or cropped so they are approximately 3 1/2" wide.
- Scan line drawings at 800 ppi resolution. Line drawings should be 3 1/2" wide.
- If you create a graph using a spreadsheet program, you must convert it from its native format (usually PICT) to TIFF or EPS. Call the editor if you need help doing this.
- DO NOT embed artwork into text files.
- Call out the approximate location of any figure in your text file. These call-outs will be removed by the editor.
- Name figure files as follows: your initials, fig#.ext. For example, Janet Smith's EPS figure 1 should be named JSfig1.eps.

Submittal of Manuscript

- Manuscripts for publication in a given year must be received by the editor no later than March 15th of that year.
- The manuscript packet must include digital and hard copies of all text and figures. Prepare text and artwork according to the instructions given in these guidelines.
- Be sure to include your name, mailing address, e-mail address (if applicable), and daytime phone number with your materials.

Acceptance and Publication

- If your article is accepted for publication, you will be notified by e-mail or mail.

- If your article is accepted, submit the following: biographical information; portrait (black and white photo or pre-scanned grayscale photo on disk); edited electronic version of the text that includes any edits recommended by the referees; and original artwork (if any) or edited digital artwork. DO NOT include your biography or portrait until you receive notice that your article has been accepted.
- After typesetting and page layout has been completed, you will receive a laser proof. Carefully examine the proof and notify the editor immediately if any errors are found.
- The Visual Communications Journal is generally published and distributed in the fall of each year.

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