Visual Communications Journal

Fall 2012—Volume 48, Number 2

International Graphic Arts Education Association, Inc.
IGAEA

Visual Communications JOURNAL

Volume 48 Number 2

FALL 2012

Acknowledgements

Editor

Dan Wilson, Illinois State University

Editorial Review Board

Richard Adams II, Ryerson University
Cynthia Carlton-Thompson, North Carolina A&T State University
Bob Chung, Rochester Institute of Technology
Christopher Lantz, Western Illinois University
Tom Schildgen, Arizona State University
Mark Snyder, Millersville University
James Tenorio, University of Wisconsin–Stout

Cover Design

Jose Soto Hernandez from Eastern Kentucky University
Instructor, Marlow Marchant

Page Design, Layout, and Prepress

Janet Oglesby and Can Le

Printing, Bindery, and Distribution

Harold Halliday, University of Houston
University of Houston Printing and Postal Services

About the Journal

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

Article Submission

Please follow the guidelines provided at the back of this *Journal*.

Membership and Subscription Information

Information about membership in the Association or subscription to the *Journal* should be directed to the IGAEA Second Vice-President.

Reference Sources

The *Visual Communications Journal* can be found on EBSCOHost databases.
ISSN: Print: 0507-1658 Web: 2155-2428

Table of Contents

Refereed Articles

Juried Articles

Student Articles

An Analysis of Illuminant Metamerism for Contract Proofs

by Bruce Leigh Myers, Ph.D. • Rochester Institute of Technology

Hard copy contract proofing remains an integral part of many printing workflows. With the exception of actual press proofs, hard copy off-press proofing technologies can be segregated into two distinct types: halftone-based and continuous tone based.

In recent years, continuous-tone inkjet proofs have emerged as the dominant hard copy contract proofing technology. A 2005 report by the Print Industries Market Information and Research Organization (PRIMIR) entitled Dynamics and Trends in Color Proofing 2005–2010, states that "Inkjet proofing has grown to be far and away the most dominant form of hardcopy proofing" (p. 4).

Despite the domination of continuous tone ink jet technology for producing hard copy contract color proofs, some print buyers continue to demand halftone-based contract proofs, and today the materials and equipment to manufacture them off-press are available and widely supported. Among the most commonly cited reasons for print buyers demanding halftone-based proofs include the ability to accurately render the halftone dots that will be imaged on press; this allows those assessing the proofs the ability to predict potential screening artifacts, such as moiré patterns. These perceived benefits contribute to the ongoing viability of halftone based digital proofing technologies in the marketplace, despite the increased costs involved in producing these types of proofs versus continuous tone inkjet technologies. Additional relevant attributes, however, could separate digital halftone based proofs from their continuous tone inkjet counterparts.

It is critical that contract proofs represent the visual conditions of the final press sheet as closely as possible. One concern rising out of these conditions is the potential realization of a visual phenomenon known as illuminant metamerism. It is possible that proofs made using different technologies which, in turn, use different colorants as raw materials, could match a press sheet when viewed under one set of lighting conditions and display a visual mismatch under another (Berns, 2000). An examination of the degree of illuminant metamerism of inkjet inks versus that of digital halftone based proofing technologies is the specific goal of the present research.

Using a metric known as metamerism index, the research endeavors to provide useful information to investigate the potential presence of illuminant metamerism via the measurement of inkjet and digital halftone proofs, as compared to ink on paper press sheets.

While relevant industry specification committees recommend controlling for illuminant metamerism through the use of standardized viewing conditions, having a better idea of the relative degree of potential visual mismatch due to changes in illumination could be relevant for stakeholders in the graphic communications industry.

Metamerism index

Developed as a single number index, the metamerism index purports to demonstrate how well two objects that match when viewed under one illuminant will match under a second, different illuminant. The index is described in CIE Publication 15.2 (1986), Section 5.2, and is illustrated below.

Metamerism index =

$$\sqrt{(\Delta L_{n1}-\Delta L_{n2})^2+(\Delta a_{n1}-\Delta a_{n2})^2+(\Delta b_{n1}-\Delta b_{n2})^2}$$

Where $n1$ is the first, reference illuminant, $n2$ is the second illuminant, and Δ is the difference between the standard and sample

Method

All printed samples and proofs were provided from four different printing organizations representative of four-color process work adhering to the specifications outlined by IDEAlliance GRACoL 7. All measurements were taken using a single X-Rite SpectroEye $45^0/0^0$ Spectrophotometer which was factory calibrated to the XRGA standard and profiled using NetProfiler technology. A white ceramic tile was utilized as a backing material for all measurements. Materials measured included process color press sheets, two types of digital halftone proofs, and inkjet proofs.

A single instrument was used for all reported measurements to minimize potential variance due to inter-instrument agreement. For each reading, spectral values were recorded and colorimetric values, specifically CIELAB at illuminant D50 and illuminant A, were calculated. The readings from the press sheets were averaged to create the standard to be compared to the respective proofing methods. Each press sheet was measured, and spectral data were recorded at two or three different areas from the color bars on each sheet, depending on sheet width.

Proofs were obtained from each of two widely available digital halftone proofing technologies, as well as for various inkjet proofs, which served as the sample readings for the calculation of metamerism index. These proofs were measured using the same criteria and procedure as was utilized for the measurement of the press sheet standards.

Results

A factorial ANOVA was utilized to examine the categorical predictor variables (proofing process, color) with the single continuous criterion variable (metamerism index). It was ascertained that the inkjet proofs exhibit the highest average across all process colors (M=1.853, SD=1.230). Of the halftone proofing methods examined, halftone method two exhibited the lowest mean average (M=0.885, SD=0.603) while halftone method one exhibited a mean metamerism index value between the inkjet and halftone method two (M=1.374, SD=6.78). This finding suggests a main effect difference due to process. Further, when examining the total results, the obtained data indicate that cyan has the greatest potential for illuminant metamerism (M=2.234, SD=0.823), followed by Black (M=1.815, SD=1.070), Yellow (M=0.797, SD=0.208), and finally Magenta (M=0.595, SD=0.211). Descriptive statistics for metamerism index by process and condition are reproduced in Table 1.

In the subsequent analyses of the data, one goal here was to ascertain if the differences in metamerism index as calculated between the inkjet proofs and the two digital halftone methods is statistically significant. The various proofing methods can be described as processes: therefore these methods are categorized as "process" in subsequent tables.

A factorial ANOVA, which utilizes an F test to measure statistical significance, was the chosen method for this analysis. The examination of the interaction effects of "Process*Condition," as illustrated in Table 2 indicate that there are statistically significant differences between combinations of the digital halftone methods and the inkjet proofs. A Bonferroni post-hoc test was conducted to clarify the nature of the significant F test.

As indicated in Table 3, the data obtained indicate that, in the aggregate, inkjet proofs are more sensitive to metamerism than their halftone-based counterparts: the mean difference of –0.968 (p<0.001) between halftone process two and the inkjet proofs represented the greatest difference observed. Further, the observed mean difference of –0.479 (p<0.001) between halftone process one and the inkjet proofs was also statistically significant.

Table 1: Descriptive Statistics for Metamerism index by Process and Condition

Process	Condition	*M*	*SD*	*n*
Halftone 1	Yellow	0.830	1.90	55
	Cyan	1.889	2.72	55
	Magenta	0.707	2.96	55
	Black	2.083	3.62	54
	Total	1.374	6.78	219
Halftone 2	Yellow	0.797	.245	54
	Cyan	1.374	5.69	55
	Magenta	0.509	0.094	54
	Black	0.479	0.066	54
	Total	0.885	0.603	217
Inkjet	Yellow	0.888	0.178	55
	Cyan	3.072	0.759	55
	Magenta	0.567	0.129	54
	Black	2.881	0.539	54
	Total	1.853	1.230	218
Total	Yellow	0.839	0.208	164
	Cyan	2.234	0.823	165
	Magenta	0.595	0.211	163
	Black	1.815	1.070	162
	Total	1.372	0.966	654

An additional analysis examined the mean differences of metamerism index for each of the process colors, categorized here as "condition," as illustrated in Table 4. As was previously discussed and illustrated in Table 1, cyan exhibited the highest overall mean in metamerism index, followed by black, then yellow and finally magenta. Table 4 illustrates the statistical significance of these mean differences.

Table 2: ANOVA for Metamerism Index by Process and Condition

Source	SS	*Df*	M^2	*F*	Δ^2
Process	102.46	2	51.228	373.13***	0.538
Condition	299.56	3	99.853	727.30***	0.773
Process * Condition	119.19	6	19.865	44.690***	0.575
Error	88.14	642	.137	54	

****p < 0.001*

Having established the statistical significance of the main effects, the study turns to an investigation of the interaction effects. The data obtained indicate that the process color cyan exhibits the greatest difference in metamerism index for inkjet proofs when compared to the digital halftone proofing technologies. Further, the process color black also exhibited a higher metamerism index with the inkjet proofs than the second halftone proofing technology, and less of a difference when compared to the first halftone proofing technology. The colorants comprising the yellow and cyan exhibit much less of a difference regardless of the proofing technology examined. These observations are illustrated in Table 5, where effect tests were utilized to determine if differences observed in the interaction display plots are statistically significant.

Discussion

The results of the present research indicate that continuous tone inkjet proofs, as measured by metamerism index, are likely to show illuminant metamerism more readily when compared to digital halftone based proofing technologies. In addition, the process colors cyan and black demonstrate metamerism as measured by metamerism index to a greater degree than magenta or yellow. This finding underscores the realization that, like so many other attributes in color reproduction, the amount of expected process variance is frequently image dependent. Proofs manufactured from images with dominant cyan and black hues in critical areas may exhibit illuminant metamerism more readily than those with primary images comprised of magenta and yellow. This finding may have an influence on those working with images that utilize large amounts of gray component replacement (GCR) and undercolor removal (UCR), where neutral areas are replaced with black inks. If the black ink is more prone to illuminant metamerism when proofed, color professionals should be sensitive to this condition.

Table 3: Individual Bonferroni Comparisons for Metamerism index by Process

(I) Process	*(J) Process*	*M Difference (I—J)*	*SE*
Halftone Process 1	Inkjet Process	-0.479***	0.03545
Halftone Process 2	Inkjet Process	-0.968***	0.03553

****p < 0.001*

Table 4: Individual Bonferroni Comparisons for Metamerism Index by Condition

(I) Condition	*(J) Condition*	*M Difference (I—J)*	*SE*
Yellow	Cyan	-1.395***	0.0409
	Magenta	0.244***	0.0410
	Black	-0.976***	0.0410
Cyan	Magenta	1.639***	0.0409
	Black	0.419***	0.0410
Magenta	Black	-1.22***	0.0411

****p < 0.001*

While this study represents a potentially important initial step in examining potential factors contributing to illuminant metamerism in hard copy proofing workflows, there are several limitations that represent areas that future researchers may choose to examine. For example, this research examined metamerism index as limited to the solid process colors (cyan, magenta, yellow and black) for two different types of halftone-based proofs as well as for several types of inkjet proofs. The present research did not examine the metamerism indices of the substrates, overprints or neutral print densities, and did not examine non-process colors or overprints. Future researchers may choose to advance into these areas by examining these particular attributes.

In addition, the present research evaluated metamerism index using CIE Illuminant D50 as a reference, consistent

Table 5: Individual Bonferroni Comparisons for Metamerism index by Process and Condition

Condition	*(I) Process*	*(J) Process*	*Mean Difference(I—J)*	*SE*
Yellow	Halftone 1	Inkjet	-0.580	0.071
	Halftone 2	Inkjet	-0.091	0.071
Cyan	Halftone 1	Inkjet	-1.183***	0.071
	Halftone 2	Inkjet	-1.332***	0.071
Magenta	Halftone 1	Inkjet	0.140	0.071
	Halftone 2	Inkjet	-0.058	0.071
Black	Halftone 1	Inkjet	-0.789***	0.071
	Halftone 2	Inkjet	-2.402***	0.071

****p < 0.001*

with ISO3664:2009. The secondary illuminant selected was CIE Illuminant A, representative of incandescent light sources. Other illuminant combinations were not evaluated here, but could be examined in subsequent studies.

It is hoped that the results of the present research emphasize the importance of those working in color critical workflows to be more sensitive to the effect of illuminant metamerism, to call attention to the fundamental need to remain vigilant about standardized viewing conditions to ensure the valid assessment of proofs, and to help to promote the adoption and use of metamerism index into the standard operating procedures as a tool for quality assurance and communication purposes.

References

Berns, Roy S. (2000). *Billmeyer and Saltzman's principles of color technology.* New York: Wiley.

CIE Publication No. 15.2 (1986) *Colorimetry*, 2nd ed., CIE, Vienna.

IDEAlliance. Specifications SWOP New! SWOP and GRACoL Specificaitons for D50 Lighting. Retrieved June 1, 2012 from: http://www.idealliance.org/specifications/swop

PRIMIR The Print Industries Market Information and Research Organization. (2005). *Dynamics and Trends in Color Proofing: 2005—2010.* Washington: NPES.

Roth, Jill. (September 1, 1997). Proofing in a Digital Age. *American Printer.* Retrieved June 1, 2012 from http:/americanprintercomalt/mag/printing_proofing_digital_age/

Essential Post-Secondary Learning Objectives For Graphic Designers

by W. Joshua Weaver, M.S. • Vincent W. Childress, Ph.D. • North Carolina A&T State University

Graphic designers today need to possess a wide variety of skill sets in order to adequately perform their duties. The skill sets include areas of study in art, design, computer technology, and print technology. It is important to determine what learning objectives in these areas, and others, are essential for a person to become a graphic designer. A need for this identification arose from an observed growing gap between art and technology skillsets. The reason for the gap may be that the range of knowledge and skills needed by today's graphic designers has increased dramatically, with an emphasis shifting toward Web technologies. To provide clarification of the essential learning objectives needed in the education of graphic designers, the researcher conducted a modified Delphi study using graphic design professionals. The results will help give instructors insight into what a graphic design curriculum should include and what skill sets are sought in the professional world.

Methodology

This study addressed one major research question: what do graphic designers need to know and be able to do in order to succeed in the graphic design field now and in the future? A modified Delphi study was used to identify the essential learning objectives needed in the post secondary education of graphic designers. The Delphi method is used as a reserch methodology to help expert panels reach consensus on complex issues.

Expert Panel

In Delphi studies, experts provide input as to what is correct, and the researcher assists the experts in reaching a consensus on that input. In this case, a population of graphic designers was solicited to participate as experts. They were contacted through the Internet at graphic design blogs. Each participating graphic designer had to meet the following criteria to qualify as an expert: 10 years of work experience (Cross, 2004) in graphic design and a two-year or four-year degree in graphic design or a closely related field. The makeup of the expert panel was unknown to the panel members, thereby eliminating the biases associated with one member being more or less revered than others.

Delphi Rounds

Delphi studies consist of multiple administrations of an instrument, which changes between each administration (Evans, 2010). In Delphi studies, the expert panel responds to an initial instrument. In a straight Delphi study, the panel of experts will develop the items that are to be included. In a modified Delphi study, the expert panel will react to a list of items prepared by the researcher, and the panel will add missing items. Round 1 of this study contained 32 items to rate, which were reviewed by a jury of experts before being delivered to the expert panel. Experts were asked to rate the importance of each item on a five-point scale, with 1 being Least Important and 5 being Most Important. The researcher then customized the instrument for the next round so that panel members could see what the responses were across the expert panel. Then panel members were encouraged to join the majority opinion (or rating) on each item or add comment on why they were not joining the majority. Subsequent rounds proceeded in this fashion. Rounds 2 and 3 for this study resulted in 43 items rated. There was a measure of consensus: the interquartile range (IQR), defined as the inside 50 percent of ratings accross the entire distribution of ratings. For this study, the IQR was set at 1, meaning that if the range of ratings on an item were 1 or less, then the expert panel will have been deemed to have reached consensus on the item's rating. Items also were excluded from the instrument when there was consensus that the item was not important or if it never reached consensus. After Round 3 for this study, essential learning objectives for which a consensus was found were listed in order of importance.

Findings

Expert Panel Composition

Over 150 people were contacted to qualify and serve on the expert panel. Thirty-two individuals agreed to participate in Round 1 of the modified Delphi study, with 27 of those individuals participating through Round 3. Participants had an average of 18.73 years of experience in graphic design or a very closely related field. The range of years of experience was 32−10=22. The majority of participants were freelance graphic designers.

Consensus Items by Order of Importance

At the end of Round 1, the expert panel added 11 additional. Of those, only three failed to reach consensus and all were rated as Important or higher. At the end of Round 3, of the 43 total items only 10 failed to reach consensus. After all three rounds, the following items had an IQR of 0 and had a median rating of 5 (Most Important):

- Understand the principles of graphic design; balance, gradation, repetition, contrast, harmony, dominance, and unity.
- Develop the ability to problem solve.
- Knowledge of printing design software such as Adobe Photoshop, Illustrator, and InDesign and working with these software applications in combination with each other.
- Know how to listen, write and speak effectively (good communication skills).
- Understand client needs, and deliver on time.

The following are some of the more interesting remaining consensus items. The complete list can be seen in Table 1. The following are some of the items that had an IQR of 1 and had a median rating of 5 (Most Important):

- Understand the elements of graphic design; line, shape, direction, size, texture, color, and value.
- Know the history and the applications of typography.
- Differentiate high quality design from poor quality design.
- Understand layout design for printing and for Web.
- Understand photo composition.
- Know how to construct a book portfolio and digital portfolio.
- Learn design as a solution to solving real world problems, through an internship or class with actual clients, products, or accompany.
- Strong, effective production skills as well as design.

The following are some of the items that had an IQR of 1 and had a median rating of 4 (More Important):

- Know Advertising and Marketing; types styles, etc.
- Understand entrepreneurship with regards to the business aspects of freelancing.
- Understanding of culture, where it has been and where it is going.

The following are some of the items that had an IQR of 1 and had a median rating of 3 (Important):

- Understand graphic design history in regards to the evolution of the field in graphic design styles and graphic design technology.
- Know uses of various Internet activities, such as social networking, for self promotion.
- Know printing applications for various substrates and ink types.

The following item had an IQR of 1 and had a median rating of 2 (Less Important):

- Understand 3D animation software, such as Autodesk's 3Dstudio Max and Maya.

Discussion

There were numerous comments posted in the Round 1, 2, and 3 instruments, which show the expert opinions of the participants on the objectives. These comments were listed on each of the Round 2 and Round 3 instruments respectively. Some of the comments can provide the profession with insights on the consensus.

Consensus Items of Interest

As of Round 3, there were several consensus items that provide reinforcement of the importance of skill sets/knowledge that graphic design students should acquire while in a post-secondary institution.

There were no real surprises, but there are some items of note. The two items related to the principles and elements of design were rated Most Important, reinforcing the stalwart fundamentals that those items represent in any design-related curriculum. However, in the face of changing technology and a crowded curriculum, an instructor could be tempted to delete the history of design to make room for another objective.

Item 4. Understand graphic design history in regards to the evolution of the field in graphic design styles and graphic design technology.

"History is always good to know."

"Important to become a more complete designer."

The panel rated this item with a median rating of 3 (Important). This item gives the designer a wealth of knowledge about the field of graphic design. The panel suggests that knowing where design has been and the events in graphic design history that have influenced the field helps to create a more complete designer and inspire

later work. It is also interesting to note that graphic design and styles are often influenced by social and economic events occurring during the same time as certain design movements. An example of this is World War II and propaganda design.

Another objective an instructor may be tempted to cut from the curriculum is the extent to which graphic design is specifically applied to advertising, but the expert panel rated that objective as More Important.

Item 6. Know advertising and marketing; types, styles, etc.

> "You need to know about different types of advertising and marketing. Your designs will change depending where it is going to be used. Example: a B2B environment vs a B2C environment."
>
> "It will be important to distinguish the differences between various types of agencies/marketing firms to determine the best fit for yourself. Know the name of the agency too. Do not just like a commercial or a print ad. Know who did it. Then figure out how the agency got the client to agree to it."
>
> "You have to know the terminology."

The panel suggests that the graphic design student needs a strong understanding of the markets for which each design is made. A participant gave the example of a business to business (B2B) environment and a business to consumer (B2C) environment and how they differ in terms of how a design is constructed and implemented. The panel also suggests understanding the difference in agencies and their clients in order to find the best fit for a graphic designer. The graphic designer should apply at a firm where he or she can bring the most value and where his or her unique skills are most needed. It is also important to understand what strategies and ideas were used by designers from particular firms to implement customer design jobs. Knowing how the product is used and seen is vital knowledge to a graphic designer producing designs for that product.

Understanding design quality, rated as Most Important, as an essential objective in post secondary graphic design education. However, instructors could be tempted to forego leading critiques in their graphic design courses. Critique is an important process for satisfying the objective of distinguishing quality design.

Item 7. Differentiate high quality design from poor quality design.

> "If the graphic designer cannot do [this], their work will be the poor quality design. Promise."
>
> "If you cannot identify high quality design then you sure are going to have a hard time consistently producing it! Or be able to convey in words (to a client, etc.) what constitutes an effective design and why it works. Again, you have to be able to back up your designs."

The panel's comments reveal that a vital aspect of producing design work is knowing why that particular design is effective and meets the requirements of the client and audience. Building an understanding of why designs work and why they do not helps to create and promote good habits in a designer.

Finally, because some graphic design programs may have been founded on traditional printing, it is important to note the expert panel's consensus regarding layout design for printing as well as the Web. It is plausible that instructors who have most of their experience in design for print may need professional development related to Web design layout. The panel rated knowing both as Most Important.

Item 11. Understand layout design for printing *and* for Web.

> "Important but very easy to pick up and understand."
>
> "Knowing the limitations associated with print production and digital is essential to designing great work."
>
> "These can be two separate disciplines (Web and Print)."
>
> "The Web is everything now. [But,] I believe that print is not dead, YET."

The panel suggests that layout for print *and* the Web is crucial knowledge to a graphic designer. A graphic design student needs a strong grasp on how to layout a specific design based on the medium in which it will be seen: printed substrate or on a display through the Web.

Non-Consensus Items of Interest

There are some items the researcher (himself without 10 years of experience) thought worthy to include based on the literature review, even though the jury did not reach a consensus. Items 17 and 20 deal with Web design and programs. Item 17 is "Know Web design software, such as Adobe Dreamweaver and Flash." Item 20 is "Know Internet languages, such as HTML, CSS, and XML." The following are comments in support of Items 17 and 20.

> "I talked recently to many creative directors and art directors. They have all stated how the advertising

and graphics industry is changing. They see the vast majority of work in the Web area rather than print. Industry is heading that way."

"Clients now want print and Web from the same designer."

"Good to know what the programming can and cannot do so that you create designs that can translate over to the Web and be exactly as you designed them."

The following are comments against Items 17 and 20.

"Find your niche and focus your skills on what you want to do best! It is HARD to stay away from the technical side of Web development. We are all designers first."

"Not in the world of packaging. As long as there are products, there will be packaging. They need graphics and they need to be printed. That is the reality of packaging and Web is ancillary to it."

"Be a Web designer if you want to learn Dreamweaver and Flash. Graphic Designer is different than Web Designer."

It is interesting that some participants felt a graphic designer is a different profession than a Web designer, although many felt if one could not do both Web design and print design an individual would be limiting himself or herself and his or her business. Participants expressed that if a graphic designer is also a Web designer, then the designer has more value as a freelancer and in a corporate setting. However on this issue consensus was not reached.

Item 21 is "Know the printing processes of lithography, flexography, gravure, serigraphy (screen printing), and digital."

A summarization of comments in support of Item 21 is:

"My specialty is package design, so that is why I rate it most important."

"It can be great design but, if it does not meet the requirements of the process in which it will be printed, it is useless. Even worse, the client was sold on a concept that cannot be produced."

"Know the limitations of each process."

The following is a comment against Item 21.

"Only if you choose to work in this field."

It is of interest that even though there was non-consensus with this item on printing production processes, there was consensus on having good effective production skills (Item 39). Comments made for Item 39 were similar to Item 21, in that the overall opinion was that no matter how good a design is, if it cannot be produced, it is useless design.

Table 1: Consensus Statistics and Ratings of Items across Three Rounds in Order of Importance

		Round 3			Round 2			Round 1		
Item	Skill Set/Knowledge	IQR	Mdn	SD	IQR	Mdn	SD	IQR	Mdn	SD
2*	Understand the principles of graphic design; balance, gradation, repetition, contrast, harmony, dominance, and unity.	0	5	.424	0	5	.712	0	5	.780
8*	Develop the ability to problem solve	0	5	.424	0	5	.456	0	5	.476
12*	Knowledge of printing design software such as Adobe Photoshop, Illustrator, and InDesign and working with this software in combination with each other.	0	5	.424	1	5	.447	0	5	.418
28*	Know how to listen, write and speak effectively (good communication skills).	0	5	.192	0	5	4.24	1	5	.629
40*	Understand client needs, and deliver on time.	0	5	.192	0	5	.526	-	-	-
1*	Understand the elements of graphic design; line, shape, direction, size, texture, color, and value.	1	5	.577	1	5	.577	1	5	.744
5*	Know the history and the applications of typography.	1	5	.580	1	5	.580	1	5	.826
7*	Differentiate high quality design from poor quality design.	1	5	.694	1	5	.694	1	5	.838
9*	Develop the ability to work on a team as a team leader and team member.	1	5	.700	1	5	.839	1	5	.832
10*	Know the design process.	1	5	.888	2	5	1.02	1	5	.916
11*	Understand layout design for printing and for Web.	1	5	.480	1	5	.572	1	5	.567
14*	Know file types (.jpg, .tif, .psd, .pdf, etc.), their operation, advantages, and disadvantages of each.	1	5	.742	1	5	.784	1	4.5	.810

		Round 3			Round 2			Round 1		
Item	Skill Set/Knowledge	IQR	Mdn	SD	IQR	Mdn	SD	IQR	Mdn	SD
15*	Understand photo composition.	1	5	.698	1	5	.694	1	4	.772
22*	Know how to construct a book portfolio and digital portfolio	1	5	.577	1	5	.577	1	5	.937
31*	Learn how to conceptualize design that follows a strategy	1	5	.577	1	5	.577	1	5	.693
32*	Learn design as a solution to solving real world problems Through an internship or class with actual clients, products, or a company.	1	5	.506	1	5	.580	1	5	.737
34*	Learn how to give constructive input on design work	1	5	.447	1	5	.542	-	-	-
36*	Know how to conceptualize with a copywriter to solve design problems	1	5	.961	1	4.5	1.12	-	-	-
39*	Strong, effective production skills as well as design	1	5	.506	1	5	.694	-	-	-
3*	Understand drawing techniques, including different mediums such as pencil, ink, and charcoal. Know how to draw to construct concept.	1	4	.801	1	3	.892	1	3	1.07
6*	Know Advertising and Marketing; types styles, etc	1	4	.730	2	4	.759	1.75	4	.766
13	Know how to transition colors from computer monitor (screen) to print media.	2	4	.907	2	4	.907	1.75	4.5	.917
23*	Understand entrepreneurship with regards to the business aspects of freelancing.	1	4	.555	1	4	.656	1	4	.756
24*	Understand the operation of a graphic design company or organization.	1	4	.742	1	4	.847	1	4	.928
29*	Know current trends in the graphic design field	1	4	.786	2	4	.834	1.75	4	.819
33*	Understanding of culture, where it's been and where it's going.	1	4	.724	1	4	.860	-	-	-
35*	Learn how to manage other designers/creatives	1	4	.934	1	4	.962	-	-	-
42*	Learn about licensing of images, music, video, etc. for resources for design work.	1	4	.620	1	4	.786	-	-	-
43	Understand how to effectively keep financial records and budget expenses.	2	4	.980	2	4	1.13	-	-	-
4*	Understand graphic design history in regards to the evolution of the field in graphic design styles and graphic design technology.	1	3	.934	2	3	1.01	1.75	3	1
16*	Understand photography dark room techniques, traditional and digital.	1	3	.629	1	3	.629			
25*	Know uses of various Internet activities, such as social networking, for self-promotion.	1	3	.751	1	3	.797	1	3.5	.911
26*	Know printing applications for various substrates and ink types.	1	3	.753	1	3	.953	1.75	3	1.06
37*	Learn CMS tools (Wordpress, Joomla, etc.) and how to design using them	1	3	.912	1	3	1.03	-	-	-
18*	Understand 3D animation software, such as Autodesk's 3Dstudio Max and Maya.	1	2	.802	1	2	.892	1	2	1.07
30	Know planning, estimating, and scheduling	2	4	.980	2	4	.974	2	4	1.06
17	Know Web design software such as, Adobe Dreamweaver and Flash.	2	3	1.15	2	4	1.28	2	3	1.29
20	Know Internet languages, such as HTML, CSS, and XML.	2	3	1.14	2	3	1.32	2.75	3	1.46
21	Know the printing process of Lithography, Flexography, Gravure, Serigraphy (Screen Printing), and Digital.	2	3	1.02	2	3	1.01	1.75	3	1.18
27	Understand the use of sustainable resources in the field of graphic design.	2	3	.898	2	3	.898	1.75	3	1.01
38	Design Iphone and related apps	2	3	1.09	2	3	1.19	-	-	-
41	Cross platform knowledge work with Mac and PC	2	3	1.04	2	3	1.04	-	-	-
19	Know computer program languages, such as C++, PHP, and JavaScript.	2	2	.892	2	2	1	1.75	2	1.29

* Indicates consensus

Recommendations

The following recommendations will be of interest to graphic designers, graphic design educators, technology educators, technology and graphic design administrators, and technology and graphic design students.

1. Infuse graphic design programs (including technical programs of a graphic arts nature) with those learning objectives identified in the study based on importance.
2. Provide professional development content related to those objectives, so educators can implement them in their curricula.
3. Provide students with a "map" of items on which they should focus to become successful graphic designers.

Conclusions

The field of graphic design has become a very broad spectrum. This study identified those essential skill sets/knowledge in graphic design in order to implement those topics into a graphic design curriculum. The skills that are essential for a graphic designer are graphic design fundamentals such as the principles and elements of design, but graphic designers need to know how to apply these fundamentals to both print and Web production. It is also essential that good communication skills and problem solving skills have already been developed in the graphic designer by the time he or she completes the post secondary program. The fact that many experts on the panel emphasized the ability to communicate with the customer and to be able to explain why a design will work as needed is a strong dose of graphic design reality. A graphic design student can develop excellent designs in school, but if he or she is not able to communicate with the customer, his or her effectiveness will be minimal. The fact that the expert panel emphasized problem solving underscores the need for the graphic designer to satisfy customer needs. A customer has a need, but certainly depends on the graphic designer to use those design elements that will solve the problem.

The graphic designer also needs to understand the difference between good quality design and poor quality design. In post secondary programs, it is easy to become preoccupied with the technical aspects of software use, but emphasis on the principles and elements of design, knowing what designs can actually be produced, and being able to communicate why the elements of a design were used are more essential skills. This means that post secondary programs need to ensure that there is time in the curriculum for oral and written critique, portfolio building, and real-life management courses. Critique and portfolio development cannot just be "covered" somewhere in the curriculum. They have to be taught on a sustained basis throughout the curriculum. With management courses included, students develop good design skills, can tell good designs from poor designs, demonstrate over time how their problem-solving skills and communication skills have developed, and end up with better internship experiences and more successful job interviews or freelance businesses.

There is one commonality between two interesting non-consensus items. One item was knowing Web programming languages, and the other was knowing printing processes. It was clear from the study that graphic designers need to know printing processes well enough to prepare the design for printing. It is plausible that there is a similar concern for Web development. It is clear that graphic design for the Web is essential, but the expert panel could not agree on advising a learning objective for creating a Website and its programming. However, it was implied that a graphic design business that is not able to complete Website development for the customer is losing market share. This is perhaps the most important area that needs to be studied further. This could be accomplished by a non-modified Delphi study that limits its scope to this particular issue. Afterward, case studies and interviews could further inform the study's findings.

As graphic design is ever changing, so too must the education that provides its foundation continue to change. By addressing new and current topics of interest and essentialness, the graphic design student is better prepared for the graphic design profession. The success of a graphic designer is determined by a strong foundation of knowledge and skills acquired through his or her post-secondary experience, as this is the place that the majority of individuals attain skills for their future careers. However, this foundation needs to be applied to realistic, customer-oriented problem-solving experiences with communication skills developed throughout the curriculum.

References

Cross, N. (2004). Expertise in design: An overview. *Design Studies, 25*(5), p. 427–441. Retrieved http://oro.open.ac.uk/3271/1/Expertise_Overview.pdf

Evans, J. R. (2010). *Statistics, data analysis, and decision modeling.* (4th ed.). Upper Saddle River, NJ: Prentice Hall.

Digital Large Format Part II: Scanning and DSLR Shift-Backs

by Chris Lantz, Ph.D. • Western Illinois University

Introduction

This study will compare the workflow and advantages of a scan-back (Figure 1) and a digital-single-lens-reflex (DSLR) shift-back adaptor (Figure 2). These are both digital capture solutions for large format cameras important for those who wish to leverage existing equipment and enjoy the advantages of a technique called camera movements. Camera movements were covered in more detail in Part I of this series (see Spring 2012 issue). Both digital capture solutions either scan or step-and-repeat overlapping pictures directly from the image plane of a large format lens. Both options share the chief disadvantage of being limited to a still life subject (Figure 3).

The purpose of comparing these two systems is cost: the DSLR shift-back adaptor is the least expensive option and a new scan-back is the most expensive solution. It is often instructive to study the least and most expensive solutions for equipment purchases to discover the range of capabilities available. Each capture technique has its own unique limitations and advantages.

Medium format backs mounted on large format cameras are intermediate in cost as a used equipment option (covered in Part I of this series). Medium format has less crop factor than DSLR shift backs and more crop factor than scan backs. Crop factor is defined as the amount that the 4×5-inch image plane is reduced by the smaller size of the sensor in the digital back. One example is a medium format digital back that has a 37×37mm sensor when compared to 4×5-inch film. Greater crop factor is generally not desired and can reduce the optical quality of an image for many large format lenses (This will be covered in Part III of this series, in the Fall 2013 issue of VCJ).

The scan-back can only use continuous light because of the continuous movement of its scanning arm, while the DSLR shift-back can use flash and is more portable. The DSLR shift-back is low in cost especially for an existing digital camera body ($200), while scan-backs can be very expensive. For example, a Betterlight scan-back is currently the only new model available in the U.S. and is $14,000–17,000 or as little as $500–1000 for a used older Phase One back. The scan-backs used in this study include an older Betterlight 4000E (2003), Phase One

Betterlight scan-back inserted into a spring back of a Cambo large format camera (left). The Betterlight back is thin enough to fit into a spring back designed for thin film holders. The universal back of this Sinar (right) is used to mount the Phase One back.

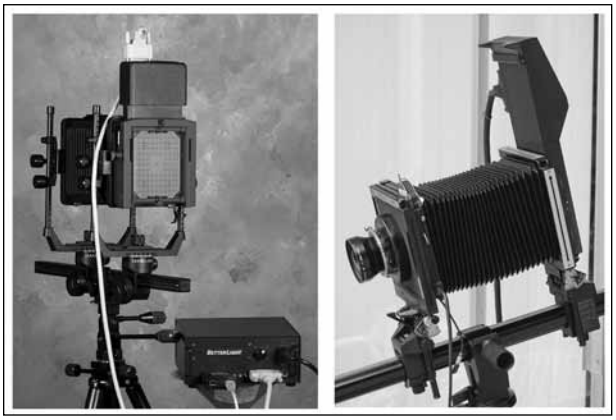

Figure 1

A DSLR shift-back adaptor allows a DSLR camera body to be mounted on a 4×5 large format camera such as this Crown Graphic that is used on a copy stand for macro or close-up work.

Figure 2

Studiokit (1998) and Phase One Powerphase (2000). The DSLR adaptor systems used in this study include a Pentax mount DSLR adaptor with a Sigma SD-14 camera and a Nikon mount DSLR adaptor with a Nikon D3100 camera body. The DSLR adaptor is more portable, using the battery system of the standard DSLR camera body. The scanning back is mainly confined to use in the studio because it needs to be tethered to a computer for scanning and has greater power requirements with a large battery system.

The linear sensor scan-backs such as made by Betterlight and Phase One capture a large area of the large format 4×5-inch image plane or ground glass viewing screen. They have very little crop factor. This makes them a good solution for standard large format wide-angle lenses designed for 4×5-inch cameras such as the common 90mm or 65mm film lenses. The DSLR shift-back has a very large crop factor, converting lenses to telephoto or telescopic effect. The DSLR back captures 2 to 5 overlapping images across the image plane of the large format camera with a small sensor (DX sized width at 24×16mm). This results in a narrow panoramic format for five images (Figure 4). A full frame DSLR camera body such as the Nikon D3 or film camera would have a greater height (such as 36×24mm) but still narrow panoramic format. Adobe Photoshop photomerge is used to stitch the overlapping images together. Multiple rows can be captured using the rear rise of the back of a large format camera (Figure 5).

A scan-back will only work for still life subjects. The second hand on this watch is distorted because it was moving at the same time the scanning wand was capturing the image on a Phase One scan-back.

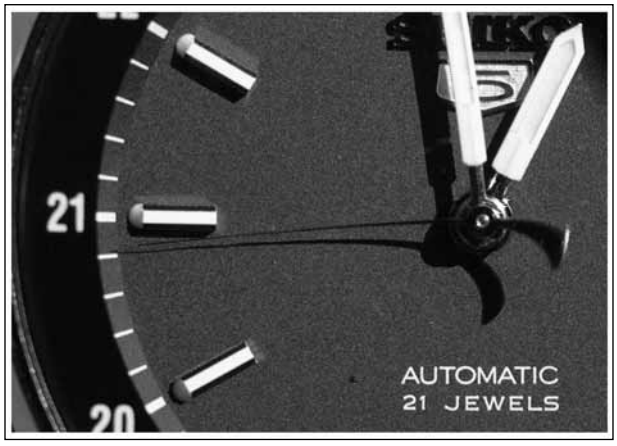

Figure 3

Five images created on a DSLR shift-back and DX sized sensor (top) that were used to stitch together the panoramic image (bottom).

Figure 4

Scan-Back Operation

For scan-backs, the camera must be firmly locked down on a tripod and all vibration of the subject needs to be avoided. Clean power such as a stable voltage transformer may be necessary because standard AC voltage can cause banding with some scan speeds (Figure 6). Scan-backs scan the projected image of the lens with a sensor wand or linear sensor, similar to a flat bed or film scanner. The sensors in scan-backs do not have the blue tinted infrared (IR) blocking filter over their sensor as they do on DSLR sensors. Therefore, scan backs require an IR blocking filter over the lens if the scene is lit by an IR rich light source. There is a daylight and tungsten version of this filter that shipped with the scan-backs. The IR blocking

Ten horizontal images created in two rows on a DSLR shift-back. The rear rise camera movement was used to create the second overlapping row of images that were all stitched together in Photoshop photomerge. The composition of this image was not exactly as desired because it was difficult to visualize the final result without a viewfinder or accurate ground glass viewing.

Figure 5

filters are expensive glass filters that can break or cloud over. They are not necessary for light that does not contain IR, such as fluorescent daylight bulbs. The back can also be used with IR rich tungsten light and an 87 Wratten filter. The 87 filters are opaque to visible light but pass IR light for infrared photography (Figure 7). A DSLR would need to be converted to IR by disassembling the camera and removing the IR blocking filter from the sensor and replacing it with an 87 filter (currently $400). Another option for DSLR-IR digital is to use a camera set up for IR, such as the Sigma SD-14 used in this study (Figure 8).

The exposure on a scan-back is determined by the line-time, which is defined as the speed that the linear sensor scans the projected image. Slower sensor scan speeds produce greater exposure and a faster movement of the linear sensor wand produces less exposure. The Betterlight backs use a with a worm gear driven by a loud continuous motor driving the sensor wand across the focal plane. The Phase One backs use a more silent stepper motor also with a worm gear. Kodak was the main producer of high-end linear sensors for film scanners and digital backs. As a result of Kodak's recent decline, they have discontinued production (perhaps to sell the patents). Some new Betterlight backs are available with the more costly, higher resolution, and higher light sensitivity sensors. The new lower cost backs are no longer available due to diminished supply of lower cost sensors.

The older 1998–2000 scan-backs with lower light sensitivity, lower resolution, and an older computer interface have remained affordable, currently at $500–2000. One example is the Phase One Studiokit. The Studiokit produces 9 megapixel images, uses an older SCSI interface (not firewire or USB) and requires very bright continuous light for optimum quality (Figure 9). One advantage of

The scan-back image on the right was created when the clouds moved over the sun at a particular spot in scanning. This caused banding that is similar to the scan lines that can occur with power brownout when lighting the subject with tungsten lamps. The normal image is on the left..

Figure 6

Image created with a Betterlight scan-back with the infrared IR blocking filter placed over the lens to create a normal visible light photo (left). The photo on the right was scanned with the #87 infrared filter over the lens creating an infrared image. The 87 filter is opaque to visible light but passes IR that almost all digital camera sensors are quite sensitive to.

Figure 7

A Pentax mount DSLR shift-back adaptor was used with the Sigma SD-14 camera body to create this IR panoramic image. The removable IR blocking filter is unique to this camera making it a good choice for DSLR-IR photography.

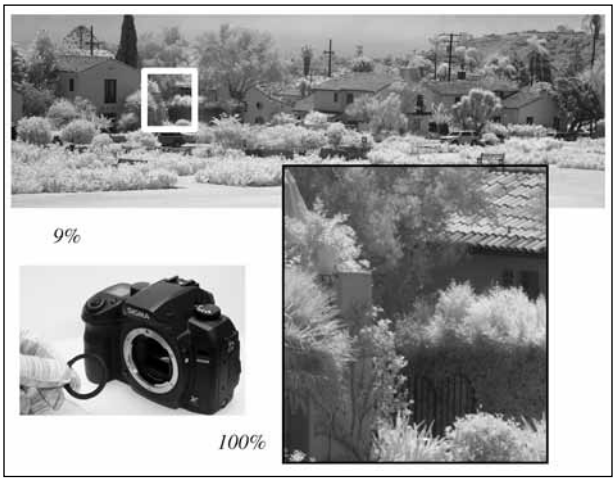

Figure 8

2000 watts of tungsten lights (right) were used to take this interior photo (left) with an older Phase One Studiokit scan-back.

Figure 9

the Phase One back is that it is self-contained with all the control electronics in the back. This is also a disadvantage because it is too thick for spring backs designed for film holders and needs a universal or Graflock connection. The images are scanned directly into the tethered computer hard drive with capture software.

On the Betterlight a separate control box is needed that contains a hard drive. Images must be downloaded from the hard drive to the computer after scanning with the Betterlight. The hard drive in the Betterlight control box is not mounted in system software and must be used within the Viewfinder capture software. The older Betterlight SCSI control boxes can be converted to the newer USB control box, but this currently costs over $2,000.

Older Betterlight SCSI control boxes use hard to find small capacity 50-pin SCSI drives. The weak link with the Phase One backs is the power supply brick that powers them. They have a standard original PC keyboard style DIN cable where the pins need to be bent outwards to make proper connection over extended use and wear. A new power supply can be sourced at an electronic supply house complete with the DIN connector. However, it needs to be mated to the scan-back connector by conditioning the pins (bent outward to make the connection). Another example of an older scan back that was not used in this study is the Dicomed back that is quite old (1997) but still serviced by Betterlight.

SCSI is usable with 32 bit Windows 7 with the correct SCSI adaptor such as the Cardbus Adaptec 1480B or can be used on old Macs that run OS9. The 32-bit SCSI standard is a mostly obsolete computer interface found on older digital scans-backs such as Betterlight, Dicomed, and Phase one. Most buyers of scan-backs will be looking for a USB or firewire interface and as a result the prices for the older SCSI equipment can be lower. The main problem with older SCSI hardware is obtaining a compatible SCSI hardware interface. Examples include a Cardbus card for a laptop or a PCI card for a tower computer. Another more expensive but convenient solution is a SCSI to firewire adaptor. The RAOC adaptor is recommended for many different scanner systems. Good quality surplus cables such as original Apple SCSI cables with short lengths can solve most SCSI problems.

The speed and age of the computer used with older scanning backs is not very important since the scanning process is slow. Newer computers will be able to use the current version of the Betterlight Viewfinder software.

Phase One SCSI scan-backs work on older Mac OS9 and Windows XP operating systems. An inexpensive Mac G4 Tower with a surplus Adaptec PCI SCSI card and OS9 (currently less than $100) is a good solution for older Phase One and Dicomed backs. OS9 is stable with these systems and it is best to dedicate a surplus computer to them. Betterlight SCSI control boxes work with almost any computer with built in firewire with the RAOC FR1-SX firewire to SCSI adaptor.

Phase One does not service the older SCSI scan-backs such as the Powerphase or Studiokit. Phase One made a firewire scan-back. The Powerphase FX Plus is still serviced by Phase One and runs on early versions of OS10, but prices for these remain high on the used market. The Powerphase FX Plus has the unique feature of a light sensor, which monitors the light during a scan. If there is a power fluctuation that dims the lights, the scan is modified real-time to prevent scanning bands. Such scanning bands can be common in some locations where power brownouts occur. This is a feature not available with the Betterlight backs.

Scan-Back Software

Scan-back software such as *Viewfinder* for Betterlight or *Capture* for Phase One have a similar workflow to film scanning software. The Betterlight and Phase One capture software is freely downloadable. The Betterlight Viewfinder software has a scan simulation mode that can be used to teach the application without a scan-back connected to the computer. The Phase One capture software requires a registration number to activate the 16bit color mode. Contact Phase One technical support email with a back serial number and they will provide the code without cost.

A preview scan is performed and then color balance, lens f-stop, ISO and line time are adjusted based on the preview results. Another prescan is done to confirm the correct exposure and color. A final scan is then performed which can take several minutes at maximum resolution on old scan-backs. Increased light, a shorter line time and lower ISO's are necessary to achieve a higher quality final scan if the preview scan has noise. Very bright lights are necessary with the older equipment with lower sensitivity sensors. For f-32 and greater depth-of-field, several thousand watts of light are needed for the older scan-backs such as the Phase One Studiokit. Bright daylight CFL's are available that can be put in four-way standard screw base bulb splitters for a very low cost

(Figure 10). Daylight 200W CFL's (16 bulbs) can run the oldest scan-backs on the faster line times for f-32 greater depth-of-field operation. The cost of 16 bulbs currently is in the $150 range. Four-way bulb splitters are currenlty about $10 each. LED array lights are also bright enough for even old scan-backs but they are currently much more costly.

Many who use especially older scan-backs for the first time comment on the high noise level of the images. This is because a stopped down f-stop, high ISO's, and slower scanning line times were used with not enough light. The highest quality scans with the least noise have low number ISO's and shorter duration scan times. With Betterlight equipment, the prescan could be missing color information (missing color channel) at the highest ISO's and longest scan times. This is because not enough light was used to fully activate the linear sensor. Scan backs are ideal for shallow depth-of-field effects and for flat subjects such as paintings. Lower wattage lighting equipment is usable with a brighter opened-up f-stop and shallow depth of field.

DSLR Adaptor Operation

The major advantage of the DSLR shift-back adaptors is an easily upgradable resolution with the purchase of future generation DSLR cameras. The adaptor is simply a camera mount on a sliding or fixed panel. This panel mounts on the universal back of a large format camera. The DSLR is slid across the image plane on the back of the camera and five overlapping exposures are taken. These five exposures are later stitched together in the photomerge feature of Adobe Photoshop. The advantage of this method is that the photos are taken from an area within the image plane of the lens. They are not taken from different camera angles such as panning the camera on a tripod. No warping and blending for the overlapping images will be necessary in Adobe Photoshop because the shooting lens was at a consistent angle to the subject.

A single household bulb fixture converted to four 200 W daylight CFL's. A bulb extender was necessary for threading the large sized four-bulb adaptor. Heat lamp fixtures could also be used.

Figure 10

Nature landscape panoramas are more tolerant to stitching errors. Straight lines are less commonly encountered in a landscape than in product or architecture photography. Any deviation from the straight product packaging lines or building sides would not be acceptable in professional work. Overlapping pictures to be blended into one image with the camera lens at different angles to linear content during shooting is problematic. The lines would not be aligned without automatically warping and distorting the pixels in the photomerge feature of Adobe Photoshop. Distorting pixels is a destructive image control method, though optical perspective correction can be non-destructive of pixel clarity if done correctly. This is especially important in small details such as the windows in a building or the sides of a product box.

DSLR adaptors are available in a less expensive, fixed lens mount plate that fits on a standard universal back. The fixed adaptor is a good choice for the monorail large format camera. This is because the monorail has a rear shift and rise movements. The DSLR shift-back is the better option for large format cameras that do not have a rear shift. This includes the Crown Graphic Press camera and the Linhof Technika technical camera described in part III of this series (to be published in the Fall 2013 issue of VCJ).

DSLR Adaptor Workflow

The sliding adaptor is moved all the way left and right in order to determine the cropping of the image. The cropping has to be pre-visualized since the whole image cannot be seen until postproduction using photomerge in Adobe Photoshop. The ground glass on the large format camera is not useful for composing the image. This is because the image on the DSLR sensor is not focused on the same plane as the ground glass. The adaptor places the DSLR further than the ground glass due to camera mounting clearance issues. A homemade ground glass extender might be possible. This extender would be difficult to construct because of tight tolerances on the placement of the image plane. One aid to previewing composition is to make a homemade viewfinder. Such a

viewfinder held up to the eye with the aspect ratio of the final image would not have cropping accuracy. However, a viewfinder of this kind may help in finding the general spot to set up the camera.

Viewing the edges of the panoramic image by sliding left and right on the shift-adaptor will reveal the dim corners of the image plane at the smallest number f-stop. There is more even illumination at a stopped down aperture. Stopping down 2–3 f-stops will eliminate the darkening in the final exposure. Test exposures can be taken at midpoint position on the sliding adaptor because the image is brighter and easier to focus in the DSLR viewfinder. One approach to DSLR shift-back photography is to use tethered shooting on a notebook computer using Nikon or Canon camera tethering software. If the raw plus JPEG mode was used on the DSLR, the smaller JPEG files can be stitched together rapidly in Adobe Photoshop photomerge to confirm cropping. The final raw files would be used for a higher quality image at postproduction. If tethered shooting is not used, then a cable release or self-timer mode with a tripod is mandatory: there is play in the adaptor sliding action, so it is not possible to trigger the camera without motion blur at slow shutter speeds. The fixed adaptors on a monorail camera do not have this problem.

Setting Up a Large Format Camera For a DSLR Shift-Back

Lenses without shutters (such as enlarging lenses) are usable because the shutter in the DSLR camera is used to make exposures. The main disadvantage to DSLR adaptors is a small utilization of the total image plane of a large format lens designed for 4×5-inch film. This means there is a very large crop factor rendering any normal focal length lens as telephoto. Many wide-angle lenses such as 65mm or 90mm are not usable at far focus distances with a DSLR because the increased space introduced by the shift-back adaptor. A spacer tube is necessary between the camera body and the shift-back adaptor due to the form factor of the DSLR not having a flush lens mount on the camera body. Lenses such as 125–135mm are the most useful for the widest-angle of view possible due to the spacer tube. Typical 4×5-inch large format film lenses are of adequate resolution for cameras of low megapixel count such as 6–10 MP. Images can be diffraction-limited when stopped down beyond optimum aperture. Optimum aperture is usually two or three stops down from the smallest number f-stop on the lens. Diffraction is the bending of light rays around small hole sized large number f-stops such as f32 to f45 and it reduces overall sharpness. Resolution is good with some sharpening in Adobe Photoshop if film lenses are used for applications that do not require stopped down large numbered apertures such as landscape or architecture. Depth-of-field requirements are decreased the further the subject is from the camera.

The physical distance between lens and camera restricts camera movements in the 125–135mm focal length range unless a bag bellows is used for DSLR's. Infinity or furthest focus distance is not possible with 125mm–135mm lenses unless a recessed lens board is used. Lenses optimized for smaller projected image sizes with a 100mm-135mm focal length such as enlarging lenses or digital specific lenses are ideal for shift-back adaptors. Telephoto lenses used in conjunction with shift-back adaptors often provide a unique flattened perspective and a very narrow angle of view but can be soft in focus for cameras beyond 10 MP.

Conclusion

Scan-backs can be affordable if compromises are made on the interface type (SCSI). They accept a wider range of lenses than the DSLR adaptor or the medium format backs covered in part I of this series (see the Spring 2012 issue). The DSLR sliding adaptor is a good way to get started in large format digital capture because of the low

Five images created on a DSLR shift-back with a film SLR (Nikon f4) and Ilford SFX 35mm film (top) that were used to stitch together the panoramic image (bottom). The cut off black lines on the extreme left and right were automatically cropped with Photoshop photomerge.

Figure 11

entry cost and easy upgrade path. The adaptors will require some experimentation for finding the correct focal length lens and recessed lens board combination. The DSLR adaptor is a good choice if enlarging an image, and copy lenses of different short focal lengths (such as 50mm–150mm) are available for experimentation. Lenses from a decommissioned darkroom or from a copy stand camera are good choices as will be discussed in Part III of this series (to be published in Fall 2013 issue). Macro or close up photography is the the easiest to set up with the DSLR shift-back because it usually does not require recessed lens boards. The DSLR adaptor can also be used with scanned 35mm film if an expensive full frame digital camera such as the Nikon D3 is not available for a slightly taller panoramic frame (Figure 11).

From Camera Obscura To Digital Color Management: Imaging Curriculum Topics And Methods

by Sara B. Smith, M.A. • University of Northern Iowa

Introduction

Imaging is one of the major components in the graphic communications field. The challenge for educators is giving students appropriate opportunities to experience aspects of imaging in a way that will relate to current and future industry practices. This paper addresses the processes and decisions involved in developing a digital imaging course within a graphic communications program.

Course Content

In conventional course development, instructors tend to think in terms of content to cover. When considering digital imaging courses, this could include quite a range of topics. For example, photography can be traced back to the fifth century B.C. when the properties of light were studied by philosophers such as Mo Tzu, then later Aristotle, Ibn al-Hazen, Joseph Kepler and others (James, 2009). Even groups of ancient people living in the deserts knew about the phenomenon of light entering through a very small hole (in this case in their tent) and then projecting an inverted image onto a flat surface (the opposite wall of the tent).

Based on many different sources, a list of potential topics to consider for inclusion in a digital imaging course was compiled (see Appendix). While this is not an exhaustive list, it is fairly complete. After creating such a list of potential content ideas, it is tempting to start picking and choosing what to include in the course. However, this does not necessarily address the learning needs of the students or the teaching strategies to employ. For example, viewing NASA photographs for two weeks might be enjoyable, yet contribute little towards the overall learning objectives. However they may warrant *some* class time. The course developer needs to have a strategy for designing the course. In other words, an instructional framework is needed.

Instructional Framework

There are literally hundreds of resources for effective curriculum development from which to choose. Arguing for or against any of these is outside the scope of this paper. It is necessary, however, to define the methodology utilized in this writing. In this instance, the author will primarily use the framework presented by L. Dee Fink (2003) in the book *Creating Significant Learning Experiences*. For curriculum development this method focuses on a learning-centered approach rather than a more traditional content-centered approach.

Fink (2003) poses a number of significant questions designed to lead instructors in course development. A very important starting question to ask is *where does the course fit within the curriculum*? This needs to be determined before moving on to additional questions. The next question is *where would you like to go*? This begins to address the more specific questions of "What are your learning goals of the course… what would you like students to get out of this course?" Once these questions are answered, it is possible to tackle the next question, which is "How are you going to get there?" (Fink, 2003, p. 258). This involves identifying the learning activities that best provide an opportunity for active learning of the course goals. There are many additional questions and ideas which Fink (2003) discusses for curriculum development. This paper will focus on those just listed.

Determining and describing how a particular course fits within a program's overall curriculum needs to be given thoughtful consideration. In order to determine the *place* of a digital imaging course within a curriculum it is helpful to look at some overall themes. Within a postsecondary curriculum for graphic communications, the bulk of what is taught could be described with four overarching terms: Capture, Manipulate, Manage, and Output. These themes describe most of the processes and considerations for handling images for communication and distribution. In a broader sense, it means that instructors want students to learn about capturing messages and images; the many ways that they can be manipulated; how they are managed in terms of workflow, storage, etc.; and finally, the methods of output. If the discussion addressed the entire spectrum of a graphics curriculum, it would include mention of communication models, software, printing methods, digital output, and more. But because it is limited to the digital imaging aspect of the curriculum, it needs to be defined in a narrower sense. Therefore, a digital imaging course has the purpose of directly focusing on the visual images of graphic communication which can be utilized and distributed with both print and digital methods. These images could be used independently, but

more often are incorporated into layouts for print, web pages, and myriad of other uses. While this may seem like a general answer to a big question, defining this now will help greatly later when identifying the specific learning goals. In fact, defining the limitations or what the goal of the course is *not* (i.e. offset printing techniques or web page design) will help to keep the planning and execution of the course manageable. Also, knowing that the products of a digital imaging course could ultimately go *into* a layout for offset printing or a web page design *does* contribute to our knowledge of topics to include in the course. For example, saving images into the best format for the output method is a topic that would logically fit within the course.

As it relates to digital imaging, each topic: *Capture, Manipulate, Manage, and Output*, could be a major educational module on its own. For example, capturing images includes cameras (film or digital) and scanners—flatbed, 3D, film, transparency. Digital cameras alone could be a course unto itself. In fact, many postsecondary schools in graphic communications or art provide courses on film and/or digital photography. That still leaves manipulate, manage and output. Manipulate could include everything from a minor color correction to complex Adobe Photoshop work. Manage includes file management, both digital and printed. Finally, output can be printed or for digital display, with many variations of each.

To address where a digital imaging course would fit within the overall curriculum, focus on the concepts and skills for capture, manipulation, management and output of images. Ideally, these skills and techniques, like the images themselves, are further utilized with other additional skills, techniques, and methods discussed in other courses. A basic example would be learning how to set up and capture (photograph) a shot of a product. The photos would be manipulated using various software to optimize the effects. Techniques of image management would also be incorporated, such as saving archival copies, determining and using the best image formats for the output, and file access and security. Finally, within a digital imaging course those product shots could then be prepared and printed using a variety of processes. Most of the focus would be on proper file preparation. However, some time and attention could also be spent on digital printing techniques as it relates to photographic images. The main goal is to develop a course or courses that add significant learning experiences to the curriculum and that support (but not repeat) the content of other courses.

Where Would You Like To Go?

The next question to answer is regarding the learning goals for the course. Depending on the instructor's relationship to the course, these may be provided, or may be a part of the curriculum development decision-making process. If all goes as planned, learning goals will be the guiding light for the learning activities to follow.

Fink (2003) presents an idea for course development that Grant Wiggins (1998) termed *backward design*. The idea is to start with the end goals in mind. It asks that you imagine a time in the future when the course is over, maybe a year or two, and then ask, "'What is it I hope that students will have learned, that will still be there and have value, several years after the course is over?' The answer to this question forms the basis of the learning goals." (Fink, 2003, p. 63).

Not only is this a logical approach, it also parallels what instructors teach students about processes in graphic communications: Always start with the end in mind. If it is known that an image is going on a web page and not a poster, then do not capture a photo with 1200 ppi. However, if there is even a *chance* that an image will need to be used in print and at a larger size, then do get all the resolution possible. Downsizing is always possible, but upsampling is problematic with mixed results at best.

So, too, can curriculum with inadequate planning be problematic. Once a course is underway, it is very difficult to change the game plan, play catch-up, or execute poorly developed goals and activities. It can be like trying to make a beautiful poster from an image that is out of focus and overexposed. Instructors do not need to change the goals for students if they were correct to begin with. The better approach is that suggested by Wiggins in Fink (2003), which is to truly clarify the long term goals for students, and then work back to helping students achieve those goals. To do this, follow up with two additional questions: "What would the students have to do to convince me that they have achieved those learning goals?" and "What would the students need to do *during* the course to be able to do well on these assessment activities?" (Fink, 2003, p. 63). These questions will be addressed later in this paper.

Learning Goals

When one is ready to identify the specific learning goals for a digital imaging course, the specifics will start to vary depending on the answer to the previous question – how does the course fit within the overall curriculum?

Another important consideration is asking whether the goal is for students to become technically proficient in performing job functions as *photographer* or *digital printer*, or whether the student will need the overall knowledge of the functions and techniques in order to *manage* a photo lab or related area. In some cases the answer might be both. Generally this is where the differences appear between a more *arts*-based program and a more *communications management*-based program. The learning goals will also help to determine the depth of knowledge necessary, as well as whether the course becomes fundamental for additional courses to build on. Some programs might determine that the quantity of goals is adequate justification for creating an additional digital imaging course.

To determine the learning goals for a course, Fink (2003) presents a comprehensive and logical taxonomy for determining specifically what instructors want students to learn in a course. This includes:

- *Foundational knowledge:* knowledge about the phenomena associated with the subject and conceptual ideas associated with those phenomena.
- *Application:* an ability to use and think about the new knowledge in multiple ways, as well as the opportunity to develop important skills.
- *Integration:* the ability to connect one body of knowledge with other ideas and bodies of knowledge.
- *Human dimension:* discovering how to interact more effectively with oneself and with others.
- *Caring:* the development of new interests, feelings and values.
- *Learning how to learn:* developing the knowledge, skills, and strategies for continuing one's learning after the course is over.

Based on these areas, Fink (2003) suggests relevant questions to answer for each category. For example, in the area of foundational knowledge, the questions are: "What key *information* (facts, terms, formula, concepts, relationships…) is important for students to *understand and remember* in the future? What key *ideas* or perspectives are important for students to understand in this course?" (Fink, 2003).

Using these questions, one might determine that " A year after the course is over, it is hoped that students will…" (Fink, 2003) *be able to understand and remember that it took hundreds of years and dozens of individuals in various disciplines to invent and develop photography*. Another goal for students would be *the ability to identify at least three photographers who were significant to our culture either through their iconic images, affecting social change, or documenting significant events.*

After determining all of the goals related to Foundational Knowledge, an instructor would continue through the rest of the areas and determine the goals for Application, Integration, and so on. Of course, not every area will have an equal number of goals. This will vary from course to course. The most important aspect is giving adequate contemplation to each of the questions and thoroughly answering each one.

After wrestling with all of the questions and considering possible goals, it's necessary to write course objectives or learning outcomes. These should be written in such a way that the knowledge, criteria, and measurable results are all identified. Learning goals need to be student-centered. This means that rather than state them as the content that instructors will cover, they should be stated in terms of what students will be able to know or do at the end of the course. Learning objectives should also identify the individual and specific skills that make up the overall goal. For example, rather than "Students will be able to understand the difference between analog and digital imaging technologies", a more descriptive and precise statement is "Students will be able to compare and contrast digital and analog imaging technologies giving advantages and disadvantages of each." In this way, learning objectives are best stated using action verbs. Finally, learning objectives need to be measurable. The measuring or assessment process will be discussed in the next section.

Course Objectives: (Stated as Student Learning Outcomes)

After successful completion of this course, students will be able to:

1. Discuss a variety of digital imaging technologies and how those technologies interact and impact society.
2. Analyze digital technology products and demonstrate how to produce projects with an emphasis on interface design concepts.
3. List and explain the available digital imaging technologies and their uses.
4. Compare and contrast digital and analog imaging technologies giving advantages and disadvantages of each.
5. Demonstrate skills and knowledge required to use and discuss digital imaging technologies.

6. Identify careers available in digital imaging.
7. Effectively work independently and in groups as required.

The answers to the questions raised by Fink (2003) and the resulting learning goals are based on several considerations. In addition to the experience and knowledge of the course developer and/or instructors, it might be necessary to include accreditation requirements for one or more accrediting agencies. Also, it is important to consider industry input to identify what employers want in future employees. A two-year institution may need to align course goals with four-year universities where their students plan to transfer. Finally, the research and curriculum development from colleagues and peers at other institutions can be helpful to consider as well.

Assessment

How will you know when students have achieved the learning goals? There are a variety of approaches to creating effective assessments. One beneficial resource is *Effective Grading: A Tool for Learning and Assessment* by Barbara E. Walvoord and Virginia Johnson Anderson (1998). This includes concepts, tips, and strategies that have been successfully implemented by many educational practitioners (Walvoord & Johnson-Anderson, 1998). In addition, Fink (2003) recommends various strategies such as providing feedback (frequent, immediate, and discriminating), creating forward-looking assessment vs. backward-looking exams, and providing opportunities for students to perform self-assessment activities. It is outside the scope of this paper to discuss these and the many other strategies suggested by researchers and experts. Instead, specific examples of assessments that the author has used will be presented.

One recommendation from Fink (2003) that this author has used is to have outside experts provide feedback to learners. For example, towards the end of the course guest judges are brought in from local photography businesses. These judges view, rate, and give feedback on the photography slide shows that the students have developed during the semester. Another example takes place during the course, when a colleague (a professor in the same program) gives a presentation on composition and other related topics. He then attends another class and facilitates an informal critique session for students to get feedback on some of their photos. This utilizes another suggestion by Fink (2003), which is to treat feedback as a dialogue and not just a one-way conversation. As students discuss aspects of their work with the instructor and other students, the potential is much greater to check on interpretation and clarity of feedback.

Another assessment exercise this author has used was suggested by Elizabeth F. Barkley (2010) in *Student Engagement Techniques: A Handbook for College Faculty*. Barkley (2010) calls the exercise a Background Knowledge Probe. It's similar to a pre-test (Barkley, 2010). For this activity, twenty-five questions were written that were considered most integral to what students need to know about digital imaging within a graphic communications program. The students were given this "test" on the second day of class, and told that it was not going to be graded. After answering as many as they could, the instructor reviewed all of their answers. Many of the questions they were not able to answer. In the next class time, the questions were reviewed one at a time. These questions set the agenda for the course. It served as an introduction to the topics, and also helped the instructor know which areas students did and did not know before starting the course. This assessment also served as a self-assessment tool for students. The same questions were given to the students throughout the semester, in groupings, and this time for a grade. The students knew that the questions would be the same, and the goal was to increase their understanding and ability to answer the questions each time they were presented with them.

Learning Activities

Once the learning goals and assessment activities have been identified, it is necessary to fill in the gap by determining the learning activities for the course. The question that Fink (2003) poses is, "What will the students actually do (the learning activities) and what will you do (the teaching activities) to make significant kinds of learning happen?" (Fink, 2003). An important concept to keep in mind is that students need to be able to practice in the same manner as they will be assessed. In other words, if students will be assessed by performing a function such as printing a photograph, then listening to a lecture on printing is not adequate as a teaching/learning activity. The lecture could serve as an introduction to the subject, followed by hands-on practice with printing.

Conclusions

Designing a course is not an overnight activity. It takes a great deal of planning, contemplation, and research. Once completed, it will generally need at least minor changes, if not a major overhaul the next time it is taught. This is

especially true in fields involving technology and newer processes, such as digital imaging.

When considering that graphic communications or similar programs include the capture, manipulation, management, and output of images, it becomes clear that digital imaging is an integral part of the curriculum. When designing such a course, it can be overwhelming to review all the topics to consider including. For reference, take into account the lengthy list at the beginning of this article. In contrast, successful course planning looks beyond lists of topics and considers the course learning goals. Fink (2003) has designed an instructional framework that was explored in this article. Using that outline, a course developer can follow this process: First, consider how the course fits into the curriculum. Second, identify the knowledge, skills, abilities, and attitudes that you would like the students to have by the end of the course, and even long after the course is over. Based on these, write clear and specific learning goals. Third, determine how you will measure or assess to what degree students have met the learning goals. Finally, design the learning activities that will create opportunities for the students to explore and reinforce the concepts and skills. By following this process, successful course development can be achieved for many different types of courses.

References

Barkley, E. F. (2010). *Student engagement techniques: A handbook for college faculty*. San Francisco, CA: Wiley.

Fink, L. D. (2003). *Creating significant learning experiences: An integrated approach to designing college courses* (1st ed.). San Francisco: Jossey-Bass.

James, C. (2009). *The book of alternative photographic processes* (2nd ed.). Canada: Delmar Cengage Learning.

Walvoord, B., & Johnson-Anderson, V. (1998). *Effective grading: A tool for learning and assessment* (First ed.). San Francisco: John Wiley & Sons.

Bibliography

Bleicher, S. (2012). *Contemporary color: Theory and use* (2nd ed.): Delmar Cengage Learning.

Charnes, G. G. (2004) *Cartes-de-Visite—the first pocket photographs* Originally published in the "Keeping History" column of the Inquirer & Mirror, summer of 2004. Retrieved from http://www.nha.org/history/keepinghistory/KHcdv.htm

Derry, T.K. & Williams, T.I. (1961) *A short history of technology: From the earliest times to A.D. 1900*, Oxford University Press

Dillard, T. (2009). *Smart object pipeline: Revolutionary tactics for the photoshop layer workflow* (1st ed.). New York, NY: Lark Books.

Eismann, K. (2004). *Photoshop restoration & retouching*: New Riders.

Galer, M. (22008). *Digital photography: Esssential skills* (4th ed.). Burlington, MA: Focal Press.

Greenspun, P. (2007) *History of photography timeline* Retreieved on 12/07/2008 from http://photo.net/history/timelineg

Kelby, S. (2008). *The Adobe Photoshop CS3 book for digital photographers*: New Riders.

King, J. A. (2003). *Shoot like a pro! Digital photography techniques*: McGraw-Hill.

Kinghorn, J., & Dickman, J. (2005). *Perfect digital photography*. Emeryville, CA: McGraw Hill/Osborne.

Klasey, J. (2002). *Photo & digital imaging*. Tinley Park, IL: The Goodheart-Wilcox Company, Inc.

Patti, T. (Dec 1993)*Historically speaking*. PSA Journal 59.n12: 37(1). Retreived on 7 Dec. 2008 from http://0-find.galegroup.com.unistar.uni.edu/itx/start.do?prodId=AONE

Reinhard, E., Khan, E. A., Akyuz, A. O., & Johnson, G. (2008). *Color imaging: Fundamentals and applications*. Wellesley, MA: A K Peters, Ltd.

Sharma, A. (2004). *Understanding color management*. Clifton Park, NY: Thomson Delmar Learning.

Wickliff, G. A. (2006) *Light writing: Technology transfer and photography to 1845*, Technical Communication Quarterly; Summer 2006; 15, 3; ABI/INFORM Global pg. 293

Appendix

1. History and timeline of the development of photography (Charnes, 2004; Derry & Williams, 1961; Patti, 1993; Wickliff, 2006)
   a. Technological, scientific and chemical advancements—glass and lenses, camera bodies, chemical reactions needed to create permanent photographs
   b. Key people—Joseph Niepce, Louis Daguerre, Elizabeth Fulhame, Alexander Wolcott, Edwin Land

2. Initial observations of the properties of light
    a. Da Vinci's writings and drawings about light
    b. Sir Issac Newton—discovery that light is made up of colors
3. Definitions, elements, and characteristics of color (Bleicher, 2012; Reinhard, Khan, Akyuz, & Johnson, 2008)
    a. Color as science vs. art
    b. Digital color—pixels and pixel depth, raster vs. vector, color models, i.e. additive and subtractive
4. Color management & reproduction (Sharma, 2004)
    a. Calibration
    b. Color profiles
    c. Gamut
5. Human vision and perception (Reinhard, et al., 2008)
    a. The biology of color—the anatomy of the eye, rods and cones, trichromacy
    b. Models of color processing
    c. Light and the Electromagnetic Spectrum
6. Photo manipulation (or post-production editing): how much is too much Photoshop? Is this a software training course?
    a. Photoshop techniques from basic to advanced (Dillard, 2009; Eismann, 2004; Kelby, 2008)
    b. Using Adobe Lightroom (Galer, 2008)
7. Photographers—contributions to society, i.e. social concerns such as living conditions, the Great Depression, etc.
8. The effect of instant images, i.e. war in our living rooms, cameras being everywhere, etc. Are people behaving differently or creating activities simply for the photograph?
9. Film photography (Klasey, 2002)
    a. Camera techniques (shooting)
    b. Setting up a darkroom
    c. Making and finishing prints
10. Using your digital camera 101 (King, 2003)
    a. Evaluating and purchasing a camera and other gear
    b. Camera controls from ISO to focus and beyond
    c. Composition and framing—rule of thirds, focal point, depth of field, lighting, etc.
    d. White balance and manipulating color
    e. File formats and save options
11. Image capture beyond cameras
    a. 3D scanners, and CCDs
12. Outputs—digital and printed
    a. Web output and multimedia
    b. Digital printing
        i. File preparation—formats, saving, archiving
13. Impacted and interactive disciplines and areas: space exploration, medical diagnosing and treatment, manufacturing, military, security, disaster services (i.e. robot to inspect damaged power plant), personal events—weddings, etc.
14. Analog to digital transformation—what is the impact? What are the processes?
15. Managing digital imaging files (Kinghorn & Dickman, 2005)
    a. Using a program like Adobe Bridge
    b. Digital Asset Management

Responsible Printing

by Adam Aune for Jerry Waite, Ed.D. • University of Houston

Introduction

In today's world of iPads and Kindles, the majority of people will still find themselves reaching for something that is printed by a press. As the population grows, so does the amount of paper that is used to keep up with the demand of printed products. As technology advances society seems to forget how much print is all around them. Think about from the time you wake up until you reach work and all the printed materials you see during this brief window; food labels and packaging, your linoleum floor, the newspaper, and business signage and billboards.

The amount of print you see daily most likely does not register as much because of the sheer amount of it in which you come in contact. This demand for print has come with the notion that printing is detrimental to the environment, since most of it is printed on paper products. This could be a possible deterrent to a promising print client who may make the decision to choose print based largely on false or outdated information. The task of understanding and delivering correct information falls on the shoulders of printers' and the print industry as a whole. Printers' have the responsibility to spread this information to printers', to the general public, and to prospective clients.

The printing industry started seeing the negative perception creep up on it as the environmental movement began to pick up steam. While older generations may remember a time when clear cutting trees was the norm for collecting wood in order to manufacture paper, that simply is not the case at this point in time. The printing industry has been responsible in its effort to clean up its industry, but getting the information delivered to the general public is another story.

The goal of this study is to catalog environmental information pertaining to the print industry so that the common misconceptions related to print can be dispelled for consumers. In order to do this, it is necessary to look at the harvesting of trees, the use of paper, and the use of chemicals in the print industry. In order to show the efforts of the print industry, the study will also include current campaigns and other possible solutions to help clear the common environmental misconceptions related to print. Like most industries, print in the past, has used methods and products that are not the most environmentally sound. Admittedly, Jo Roberts (Printing, 2007) claims, "Many people think the print industry is a massive polluter, but it has been responsible, and there has definitely been more emphasis on environmental issues."

Harvesting Trees

Over the past several decades environmental concerns have been raised across the board to every industry that conducts business. During this time the print industry has been targeted through misconceptions as being responsible for the destruction of rainforest and woodland areas around the globe.

So how does the print industry actually go about getting the wood it uses for paper? Not by deforestation, or what is commonly referred to as clear cutting. According to Encyclopedia Britannica (2011), "In the practice of clear cutting, all the trees are removed from the land, which completely destroys the forest." This is the practice that many associate with the harvesting of rainforest timber whose land is then in turn used for palm oil production instead of re-growing the forest. Quite the opposite is true for the printing industry. One of the major misconceptions of the print industry is that if we keep using trees at the rate we currently do that we will run out of trees. The majority of the paper the print industry uses comes from forests called managed timberlands which grow trees specifically for human use (The Leading, 2001). When trees are grown this way they become a renewable resource. The Leading Technical Association for the Worldwide Pulp, Paper and Converting Industry (2001) states, "More trees are destroyed by fire and insects than are cut down to make paper."

There are several benefits of managing forests this way. According to the North Carolina Forestry Organization (Frequently Asked Questions), "The young saplings that grow in areas where trees have been harvested play a critical role in keeping our air and water clean. Younger, actively growing trees absorb more carbon dioxide and produce more oxygen than overly mature trees." The main idea for planting this way is that carbon dioxide released from using fossil fuels will be neutralized by the increased use of carbon dioxide by the trees (Top of the Tree, 2003). Other benefits include increased area for animal habitats; encourages root systems that help reduce

soil erosion, and promote the growth of other plants that produce food for animals (Frequently Asked Questions). By far the single most important benefit of using managed timberlands is that a tree that is used for making paper will have five more planted in its place (Paper University, 2001). The fact that each tree that is used is replaced by five more should dispel much of the notion that print is destroying our forests.

There are two main campaigns the industry is currently supporting in order to spread the message of strides taken to become viewed as an eco friendly industry in regards to the use of trees. The first campaign is *Print Grows Trees*, which is supported by Printing & Graphics Association MidAtlantic, and according to the campaign's website "is an educational campaign that uses facts to show that print on paper actually helps to grow trees and keep our forests from being sold for development (Printing & Graphics Association MidAtlantic, 2010)." As in the title, the major objective of the campaign is to dispel the myth that by using less paper more trees will be saved.

Another campaign the industry has backed is called *Choose Print*, which is supported by Printing Industries Association, Inc. of Southern California. Much like *Print Grows Trees*, *Choose Print* also houses facts on the print and paper industries that help prove print myths wrong. *Choose Print* emphatically notes (Printing Industries Association [PIA], 2010), "The idea that print is detrimental to the environment is factually wrong." Additional industry campaigns that provide information on tree and paper facts can be found on the website accompanying this study at http://cot-digital.tech.uh.edu/~AuneA/responsibleprinting/.

Use of Paper

To help further dispel the notion that the use of paper is detrimental to the environment it is necessary to look at the paper being used to print on. The print and paper industries are moving towards a more green approach to bolster their environmental performance. Another common misconception is that green products are generally more expensive than their original counterparts. The price of non-recycled paper versus that of recycled paper is relatively the same depending on the grade of the paper (DeWitt, 2008). The industry has started giving out certifications for different types of eco friendly paper. These certifications help to ensure that the paper labeled by an organization below will meet or exceed environmental benchmarks set by governments around the world.

The Forest Stewardship Council (FSC) was established in 1993 (The Paper Mill Store, 2011). According to the FSC website (Forest Stewardship Council, 2011), "FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests." The FSC logo is used to show that the fibers in a specific type of paper have been harvested from managed forests. It is also used to show the chain of custody of the raw material through the manufacturing and processing of the raw materials (Forest Stewardship Council [FSC], 2011). This means from the time the tree is harvested in a managed forest until you open the package of paper that it has changed hands only through companies who practice responsible production.

The Sustainable Forestry Initiative (SFI) was launched in 1995 to combat concerns related to forest management and illegal logging (The Paper Mill Store, 2011). The SFI website lists several principles for forest management (Sustainable Forestry Initiative [SFI], 2011): Protecting water quality, biodiversity, wildlife habitat, species at risk, and forests with exceptional conservation value. SFI sets requirements that must be followed in order to gain the right to use the SFI label on printed materials. In order to prove that a company has met these guidelines they must be audited by independent, third-party certification bodies (The Paper Mill Store, 2011). SFI also offers several labels to be printed on products that meet their requirements. Much like FSC, SFI incorporates a certified chain of custody label which shows the percentage of certified forest content, certified sourcing and post consumer recycled materials (Sustainable Forestry Initiative [SFI], 2011). The main difference that sets the SFI apart from the FSC, is that SFI has structured guidelines that are audited by a third party. Again, this is a step the industry has taken to help inform customers at the point of purchase about the environmental friendliness of the paper. Similar to the FSC, SFI can't force consumers to buy products bearing their logo. They can only suggest the product by the appearance of their logo.

The Programme for the Endorsement of Forest Certification or PEFC is another organization that monitors the source of wood fibers that are used in paper production. Similar to the FSC and SFI, the PEFC also awards certain labels to companies and forest owners who have been certified. They offer certifications for forests, chain of custody, and timber procurement (Programme for the Endorsement of Forest Certification, 2010). According to the PEFC website there are several things

that set them apart from the other certification bodies (Programme for the Endorsement of Forest Certification, 2010):

- The world's largest forest certification system.
- Follows globally accepted ISO guidelines for certification and accreditation.
- Strictly separates standard-setting, certification and accreditation to ensure complete independence and impartiality of these processes.
- Requires that all standards undergo public consultation at national and international level and third party assessment.
- Sets highest standards for forest certification and sustainable forest management aligned with the majority of the world's governments.
- Additional information on the certification processes and use of logos can be found at http://cot-digital.tech.uh.edu/~AuneA/responsibleprinting/.

Use of Chemicals

Another area of concern for the printing industry is the dependency it has on chemicals, especially with the introduction of petroleum-based inks in the 1960's. The petroleum-based inks had replaced what the industry had previously used, vegetable-based oils. The main reasons the industry made the switch over to petroleum-based inks was because the petroleum-based inks were cheaper to produce and dried faster than their vegetable-based counterparts (Lee, 2010). However, over time research had been conducted that showed petroleum-based inks were harmful to the environment. The National Association of Printing Ink Manufacturers released a report in 2008 which listed several ways for printers to reduce the impact printing on the environment in regards to inks and chemicals. This information can be found through a link provided at http://cot-digital.tech.uh.edu/~AuneA/responsibleprinting/.

Volatile organic compounds are the main problem when looking at the environmental impact of the ink and chemicals used by the printing industry. The VOCs are released during the evaporation or drying of the inks as well as the use of cleaning solutions. The main issue with the VOCs is that their emission can form photochemical smog or ozone, with many of these VOCs labeled as hazardous air pollutants that can affect the health of the workers who use them (McCourt, 1999). With the release of the British Printing Industries Federation carbon calculator, firms can now measure the total carbon footprint of a one-off print job in addition to the total annual carbon footprint (Baylis, 2009). This allows firms using the calculator to see the environmental impact of their printing from the paper production to the end use of the product. The Printing Industries Association of Australia released a report on how to reduce the amount of VOCs, this information can be found on the website that accompanies the study. This list allows printers who may not have the funding to buy new machinery the chance to be environmentally conscious as well as providing established printers a template or guidelines to follow in order to reduce their VOC output.

In 1994, Congress passed the Vegetable Ink Printing Act. The response to this legislation by the industry has been positive since the industry standard has become vegetable oil-based inks. This bill required that government contracts given out to printers were mandated to use vegetable oil-based inks instead of their petroleum-based counterparts (EnviroFriendly Printing). Similar to most items handed out at the federal level, several states have passed similar legislation. The main benefit of using the soy-based inks over the petroleum-based is that the petroleum-based inks contain VOC levels from 25% to 40% versus the single digits that soy boasts (Soy Inks 1994). According to the National Soy Ink Information Center website (National Soy Ink Information Center, n.d.), which is now closed, "The soy industry is such a success that you don't need us anymore!" Currently, soy-based inks can even be found in cartridges and toner for consumer use at home. Using the soy-based inks provide many advantages over the petroleum-based inks not only in the environment but also the press room. Chasing Green, a group dedicating to spread the word of green print, lists several advantages of soy-based ink (Chasing Green, 2010):

- Producing soy-based inks requires only .5% of the total energy needed to produce petroleum-based inks.
- Soy-based inks also spread 15% further than petroleum-based inks, reducing the number of landfill-bound containers.
- Soy-based inks provide more intense color.

Conclusions and Recommendations

This study was initiated in order to observe, analyze, and document the strategies that the printing industry has deployed in order to dispel the negative perceptions that revolve around the perceived detrimental impact of print

on the environment. To ensure that the sources used were valid and presented in an unbiased factual format, each source had to have one or more of the following requirements:

- Published in an academic journal.
- Published by industry or academic entities.
- Published on industry-sponsored website.

The results of this study were compounded into a website that allows users to easily access information pertaining to the efforts the industry has taken to go green and can be found at http://cot-digital.tech.uh.edu/~AuneA/responsibleprinting/.

During the course of the research conducted during this study one item became increasingly clear. The fact that the information provided in the accompanying website could be found across the web but not in a single location that was easy to navigate as well as containing enough options to let visitors form their own opinion. A fair portion of the available information only covered a select area of environmental printing.

In order to further spread the use of correct information it is recommend that any respected printing industry gateway, such as Graphic Comm Central, link this informative website. The website that was created for this study was done so for free use and is available to all who wish to use it as an educational tool. Additional content can always be added for parties who wish to make use of the website by contacting the Digital Media Program in the College of Technology at the University of Houston.

Bibliography

Baylis, C. (2009). Looking good on paper. *Green Futures*, (72), 41. Retrieved from EBSCO*host*.

Chasing Green. (2010). *Soy based ink available for home (and office) printers*. Retrieved from http://www.chasinggreen.org/articlesoy-based-ink-available-home-and-office-printers/

Deforestation. (2011). In *Encyclopedia Britannica*. Retrieved from http://www.britanica .com/EBchecked/topic/155854/deforestation

DeWitt, M. (2008, February). PAPER Moral Fiber.*Print Professional*,46(2), 26-28,30. Retrieved March 8, 2011, from ABI/INFORM Global.

EnviroFriendly Printing. *Soy/vegetable inks*. Retrieved from http://envirofriendlyprinting .com/content/soy-vegetable-inks

Forest Stewardship Council, (2011). Retrieved from http://www.fsc.org/

Frequently asked questions. Retrieved from http://www.ncforestry.org/WEBPAGES /MORELINKS/FAQ/answers.htm

Lee, L. (2010). *How is petroleum used in ink?*. Retrieved from http://www.ehow.com/facts _7360962_petroleum-used-ink_.html

McCourt, A. (1999). *Reducing voc solvent use in the printing industry*. Printing Industries Association of Australia. Retrieved March 8, 2011, from http://www.printnet.com .au/verve/_resources/VOC_Report_-_members.pdf

National Association of Printing Ink Manufacturers. (2008). *Formulating inks to minimize environmental impact*. Retrieved from http://www.napim.Org /Public Area/Printers/Enviro.aspx

National Soy Ink Information Center. (n.d.). Retrieved from http://www.soyink.com/

Printing & Graphics Association MidAtlantic. (2010). *Print Grows Trees.* Retrieved from:http://printgrowstrees.com/facts.html

Printing Industries Association. (2010). *Thoughts about paper*. From http://chooseprint.org/TAP.html

Printing; Print gets keen to be green. (2007). *In Store Marketing*, p.45. Retrieved March 9, 2011, from LexisNexis Academic.

Programme for the Endorsement of Forest Certification. (2010). Retrieved from http: //www.pefc.org/

Soy inks. (1994, April). *Editor & Publisher*,127(14), 9E. Retrieved March 22, 2011, from ABI/INFORM Global. (Document ID: 386656).

Sustainable Forestry Initiative. (2011). *SFI labels and claims.* Retrieved from http:// www.sfiprogram.org/SFI_labels_and claims.php

The green printing press. (1998, February). *Printing World*, 34. Retrieved March 16, 2011, from ABI/INFORM Trade & Industry.

The Leading Technical Association for the Worldwide Pulp, Paper and Converting Industry. (2001). *Paper University.* From http://www.tappi.org/paperu/

The Paper Mill Store. (2011). Retrieved from http://www.thepapermillstore.com/

Top of the tree. (2003, August). *Printing World*, 18. Retrieved March 9, 2011, from ABI/INFORM Trade & Industry.

Print Adaptation in a Technology Expanding World

by Tinisha Bonaby for Jerry Waite, Ed.D. • University of Houston

Introduction

Print began declining when the Internet became popular in many homes of America in the 1990s. In the 1980s two men, Tim Berner-Lee and Robert Cailliau, invented the World Wide Web and this provided opportunities in looking for information by the way of Internet. Major companies and people see the web as a potential place to advertise, gain information, and spread their businesses (Michael, 2010). Technology and Internet outlets have been affecting the print media industry negatively, with this issue increasing year by year. How can a business that is currently in the printing business adapt and thrive? This research will help businessmen figure out the best combination of media to market their product, present new ways for print media to work with technology, and change the way companies market information to the consumer.

Literature Review

The first form of print media on the decline is direct mail. Postal companies have been in a decline lately because of the economy, e-mail, and the fact that individuals can do most of their financial business online. Borrell predicted in 2008 that there would be a 39% decline for traditional mail by 2013 (O'Malley, 2009). E-mail and the Internet is a faster way to get information out to people; direct mail takes a couple of days. With the Internet, people can speak to family; send them pictures from vacations, and reconnect with their friends from all over the world instantly. Since Borrell's prediction, the Direct Marketing Association had released a digital marketing practice and trends report in July 2010 that stated that print media has declined very slightly but still remains steady, while web marketing over the next year is expected to rise (Read, 2010). To recover their losses, postal service businesses have increased the cost of postage stamps and delivery costs. In the last ten years stamps went up a substantial 10 cents and this increase is expected to continue (Dart).

Since the release of e-readers like Amazon's Kindle, iPhone, and Sony Reader the popularity of e-books has been on the rise. Based on the Association of American Publishers, E-book sales for popular books are seeing e-books as 30% of their first week sales while printed books from the most famous authors are seeing a decline on sales (Dericho, 2010). One of the largest booksellers, Amazon.com, states that the sales for its e-reader did substantially better than the sales of hard cover books. The website sold 143 Kindle books for every 100 hard-cover books, including the books for which there is no Kindle edition (Miller, 2010). College students have been taking advantage of books being offered online whether they have an e-book reader or renting them offline to read on their laptops. Eileen Mullan quotes a teacher in her article and mentions that students find e-textbooks helpful. Overby stated 75% of her students used e-books more than printed books because "all the digital assets are incorporated in the right spot" as well as the ease of sharing class notes. (Mullan, 2009). E-books offer more than what a normal book can; they allow highlighting and note taking without having to worry about it being permanent because it can always be erased. Another handy feature is searching certain text and phrases throughout the book.

Newspapers and Magazines are two more forms of print media on the decline. In 2008 over a third of newspapers were read online. This is being driven by a shift in how younger generations read newspapers (Pew Research, 2009). Younger people are turning to the Internet, using search engines such as Yahoo, MSN, or Google to look up news information. When this is done, curiosity about a specific story takes them to an online newspaper. It is said that 50% of online consumers access news sites indirectly by following links and that 64% of people younger than 25 follow links to stories (Pew Research, 2009). This proves newspapers are still being read, but the online versions are getting more attention. Magazines are not fading away as fast as newspapers, but they are still not as popular as they used to be. Irvine (2010) has found that Reader's Digest circulation is falling at 25%. In a Bloomberg article, Bensinger states that Doctor believes that magazine publishers will be looking into tablets such as Apple Inc.'s iPad to grab attention from advertisers and readers. "[Doctor] Tablets give magazine publishers a chance to present their content in a totally new way" (Bensinger, 2010). Businesses must keep up with the latest technologies to keep attracting readers and collecting revenue.

Though it is projected that newspapers, magazines, directories, and direct mail will likely decline by 2.9 percent in the year of 2011; print media could capitalize on mobile

and online advertising (Print in the Mix, 2011). A good website needs print media to advertise it, otherwise most would never know the site exists unless the user happens to find themselves there through a series of mouse clicks. Print media could be used to advertise quick information about a product or service to interest the customer to go to the company's website for more details. The use of QR codes (Quick Response Code) on print media can be resourceful because it allows the customers to take a snapshot of the code and immediately lead them to the website. Jonathan Kay of the National Post has three ideas that print companies should use to save print media: business-oriented media, premium publications, and hyper local newspapers (Kay, 2008). All three of these ideas have personalization in common.

Method

The project began with a survey consisting of four questions asking print professionals and company managers about how they are dealing with the declining trend of print media and what are they doing to compensate for lost sales. A request to participate in the survey was posted to the LinkedIn pages of various professional groups, including International Graphic Arts Education Association (IGAEA), Houston Production Managers Association (HPMA), Print and Graphics Scholarship Foundation (PGSF), and Printing Industries of America (PIA). In addition, members of the Houston Production Managers Association (HPMA) were given an informative flyer and asked to participate in the study during their December 2011 monthly meeting. Joe Barber, vice president of CodeZ QR, advsed on how people in the print industry are integrating with technology to stay profitable. Barber suggested setting up a phone conference with Andy and Julie Plata, proud owners of multiple successful businesses: American Printer, COPI, and OutputLinks Communication Group. He mentioned they are releasing an innovative personalized magazine called B2MeMagazine and thought this would be good information to include in this research.

Print professionals need to know the target audience and how to market to them to sell a product or service. To find out what type of media people preferred, an online survey answered by 100 respondents was conducted to represent average consumers who use print and digital media. To do this, a Likert scale type of survey was used. The survey link, created by surverymonkey.com, was posted on different Facebook groups as well as administered to college students to gain participants.

Results

Complete survey responses were received from 15 different print professionals from the United States and Canada. The responses to the four questions that comprised the survey are located in Appendix A. Regarding question one, 67% of my respondents said their company profits have decreased, 20% feel their company profits have stayed the same, and the last 13% said company profits have increased over the last 5 to 10 years. It is clear that the majority of the responses said their company profits have decreased and agree that electronic media is replacing print. The more traditional printing methods such as offset printing are decreasing in popularity, yet things like variable data printing, digital printing, and QR codes are getting used more and more. Some of the more interesting responses stated were that company profits were increasing until the 2008 economic crash and has yet to return to pre-2008 levels. It seems like businesses are deciding to scale back and not have as many printed products as they used to. Instead, they send PDF files and if something does need to be printed, it is in black and white because it is less expensive.

Question two researched the main reasons why mainstream print businesses have been buying up smaller print companies. Some of the reasons were because they want the smaller company's client base and prefer to have all departments under one roof to avoid paying for services from other companies. Furthermore, this gives the larger company more added value and different services to provide to their customers. Smaller companies are usually family-owned and not able to maintain their capital when times are hard economically. Smaller companies often have no choice but to sell their company to a bigger one unless they want to file for bankruptcy in the future. One respondent felt that integration is not always necessary to survive. Being willing to accept new technology, running lean manufacturing operations, and investing in the established people are the things necessary.

Question three helped discover ways businesses adapt and thrive in the technology-dominant age. There was a recurring response about buying new equipment and creating new services to a faster turnaround for products to consumer. Most have learned the new technology and have added them to the services provided, creating new products. One of these new services allows customers to order their printed products online and when they are done inputting all their information the job goes to print. Not all companies focus on print to adapt; some pay

particular attention to the workflow, as well as try to provide superior customer service to keep clients. One respondent believes that the biggest negative print companies face is the sourcing of printed material offshore or from large providers outside the business areas that traditionally provided print jobs. It was also stated that companies that have adapted/thrived have something to offer that is not being satisfied by technology and Internet outlets.

Twelve of the respondents are using some type of cross-media communication in their business and said it is affecting their business in a positive way. One of the screen-printing companies creates the touch screen interfaces for iPhones and iPads, RFID tags, antennas, and graphics on most devices. Another company enjoys using Capability Maturity Model software and believes it will be a big contributor to their business in the future. It has an all digital strategy and adds value to the communication process. An increasing number of university's recruiting departments are using a three way "touch" to gain perspective students. They would first send a postcard, followed by an email, and then a phone call. This is a perfect example of using the same information and using different media to market different ways. One more technology that is being incorporated in one of my respondents companies is security or brand protection. This is an excellent area to get involved with because a lot of upcoming companies worry about their brand being copied. As a printer, cross-media communication is important to understand because of the fact it is an essential function and will serve to maintain business and gain new customers.

In addition to surveying print professionals, the project involved a phone conference with Andy Plata to find out details on real life projects going on now involving my topic. To increase profits for his company Plata has used cross-media communication as well as personalization. Plata developed the main concept of Business to Me Magazine. The B2MeMagazine (B2Me) is a highly personalized magazine for each individual that subscribes. The concept of B2MeMagazine is a branch of a prior traditional print publication method called B2B. Plata is planning on re-launching his company's magazine, American Printer; in the B2Me format March 2012. What makes this type magazine different from the previous version is the fact that everything is geared towards the individual and it is interactive. Plata is aware that people enjoy the interactivity and personalization of the web. So he thought: "Why not apply this same concept to magazines and newspapers?" To create this personalization in his product, he added web launch points and used QR codes throughout to lead subscribers to personalized web pages (PURLS). It was important to incorporate social media and apply it to the magazine.

Plata is fully aware that creating this type of magazine is more expensive than creating an old fashioned magazine on the press. Instead of worrying about that, he chooses to focus on the value that the B2Me magazine can offer. It is going to cost him more money to make more money. In the print industry, a regular full-page ad in a magazine costs about $3,500. In the B2me magazine a full-page ad is $20,000. The reason why they can charge $20,000 for an ad in the B2Me magazine versus a regular magazine is because the $20,000 ad becomes a major lead generator for the advertiser. When the B2Me ads' or articles' QR codes are scanned, it takes the person to their special landing page and allows to them have a dialogue with the advertiser or article writer. The site automatically lets the advertiser know the person's name, company they are working for, address, phone number, and other demographic information. In addition, the advertiser now has a lead on who is interested in their product and can market more information to them in the future to potentially make a sale. With all the value added, purchasing an ad in the B2Me magazine is worthwhile to an advertiser.

When asked who else is on the leading edge of innovative product/service involving integrating print and digital media; he replied that the B2MeMagazine is the first one of its kind and currently has no competitors. Plata hopes to show printers trying to increase their sales volumes how adding value to their products will help them make more money. The biggest challenge for most printers is the fact that they focus on print so much that they reject anything on the web or social media. Therefore they become unaware of it and cannot adapt and figure out how to control it. Plata mentioned that printers are good communicators and have the tools to help assist, but unless they understand the messaging of today they cannot apply their wisdom to it. It is best to take the few pages being printed, add more value to them, make more money, and be a happy and profitable printer.

Part two of the study involves ten different questions (located in Appendix B along with results). From these questions it was discovered that people do not have a set preference of whether they want print or digital media. It all depends on the person, reason, or situation it is used for. Over half of the people surveyed preferred a printed

traditional birthday card rather than an e-card (Figure 4). Another example is the majority vote of preferring a printed textbook over an online copy (Figure 6). Yet, the majorities of the respondents do not prefer to receive direct mail over e-mail and prefer to receive their news updates from the Internet (Figure 1). This proves that people are indecisive and do not know exactly what they want. Many of the people surveyed are more comfortable reading a paper magazine than an e-magazine (Figure 7). This could be a personal preference or because of the fact staring at a computer screen all day strains the eyes. A perfect bell shaped curved was formed on responses regarding a preference for print or online advertisements (Figure 2). The bell curve indicates that most of the respondents are ambivalent about which sort of media they prefer. This is an indicator that the transition to non-print media is incomplete. For social activities, such as staying connected with friends and family, the Internet prospered (Figure 3). Only 5% of the respondents said they do not keep up with their friends and family this way. It was also evident that most people do not utilize the QR function on their smartphones (Figure 10).

Conclusions and Recommendations

It would have been informative to know which media each individual age group prefers. This research could have been enhanced by asking for the demographics of the person surveyed. Ultimately, companies have to weigh the pros and cons of each medium. Mass communication is becoming a thing of the past; therefore it is important to find the target audience and market to them with the correct medium. There are a variety of different options for print companies to stay in business and increase profits for their company by using different techniques such as cross-media communication and personalization. Though print media is losing its dominance, it will never be completely gone. Print professionals will have to continue researching ways to add value to their printed products for businesses. Hopefully, with careful planning and good management, it will help print media stay successful.

References

Bensinger, G. (2010, August 9). *Reader's digest leads magazine circulation declines*. Retrieved from http://www.bloomberg.com/news/2010-08-09/u-s-magazine-circulation-falls-2-3-in-first-half-led-by-reader-s-digest.html

Dart, A. (n.d.). *The history of postage rates in the United States*. Retrieved from http://www.akdart.com/postrate.html

Irvine, D. (2010, August 10). *Magazine circulation continues to slide*. Retrieved from http://www.aim.org/don-irvine-blog/magazine-circulation-continues-to-slide/

Kay, J. (2008, November 6). *Jonathan kay: how to save the print media*. Retrieved from http://network.nationalpost.com/np/blogs/fullcomment/archive/2008/11/06/jonathan-kay-how-to-save-the-print-media.aspx

Michael, S. (2010, May 14). *When did the internet start?*. Retrieved from http://www.articlesbase.com/education-articles/when-did-the-internet-start-2367225.html

Miller, C. C. (2010, July 19). *E-books top hardcovers at amazon*. Retrieved from http://www.nytimes.com/2010/07/20/technology/20kindle.html?_r=1

Mullan, E. (2009, May). Ebooks Rewrite the Rules of Education. E Content, 32(4),12–13..Retrieved October 15, 2010, from ABI/INFORM Global. (Document ID: 1712417421).

Newspapers face a challenging calculus. (2009, February 2009). Retrieved from http://pewresearch.org/pubs/1133/decline-print-newspapers-increased-online-news

O'Malley, G. (2009, May 20). *Direct mail doomed, long live email*. Retrieved from http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=106491

Read, B. (2010, July 20). *Dma reports: e-mail to surpass direct mail, social media popular, slight growth in telemarketing*. Retrieved from http://outbound-call-center.tmcnet.com/topics/outbound-call-center/articles/92484-dma-reports-e-mail-surpass-direct-mail-social.htm

Sterling, G. (2009, May 21). *Borrell: direct mail next to go*. Retrieved from http://gesterling.wordpress.com/2009/05/21/borrell-direct-mail-next-to-go/

Borrell associates. (n.d.). Retrieved from http://www.borrellassociates.com/reports/industrypapers/newspapers

Why email metrics are in decline. (2010, July 6). Retrieved from http://www.emarketer.com/%28X%281%29S%28vx4ulvrlxhkizjqtziilra45%29%29/Article.aspx?R=1007831&AspxAutoDetectCookieSupport=1

World wide web history . (n.d.). Retrieved from http://www.livinginternet.com/w/wi.htm

2011 US Media ad revenue: Steady Growth As Print Declines, Digital Grows. (2011, February 18). Retrieved from http://printinthemix.cias.rit.edu/fastfacts/show/411

Appendix A

The questions for print company managers would be:

1. If known, how have company profits been with regard to clients ordering print products over the last 5 to 10 years? (increased, declined, stayed the same) Is there a specific reason why?
2. Some of the mainstream print businesses have been buying up smaller print companies. Could it be because there is not enough business coming in for print media? Do you think that companies must integrate with others to survive?
3. Recently, technology and Internet outlets have affected the print media industry negatively. With this issue increasing year by year, how has your business adapted and thrived during this situation?
4. What do you think about cross-media communication? Has your company ever done any projects like this?
5. Is there anything else you would like to add that can help further my research?

Appendix B

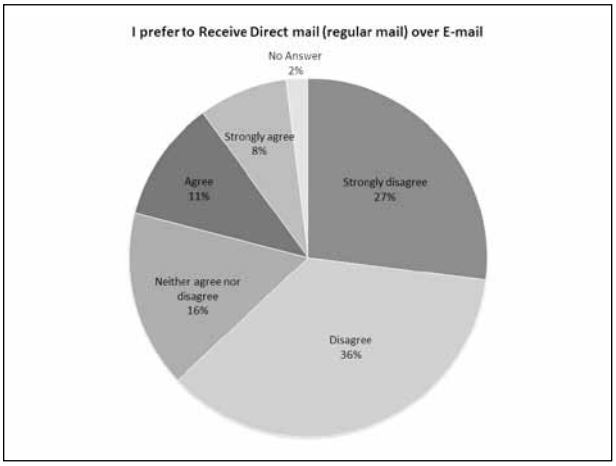

Figure 1

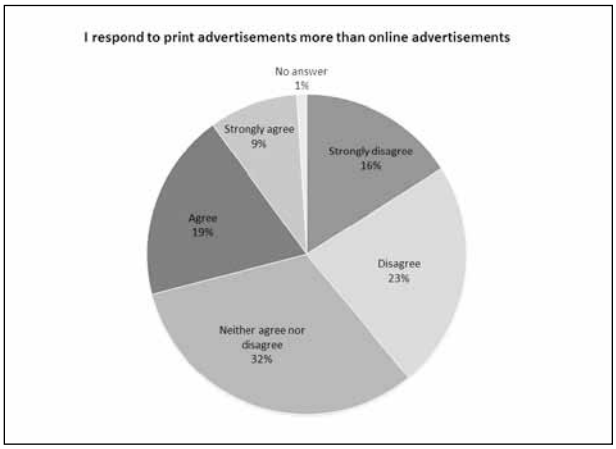

Figure 2

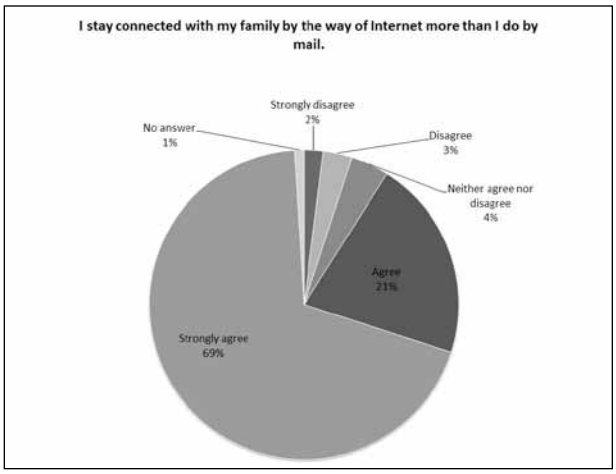

Figure 3

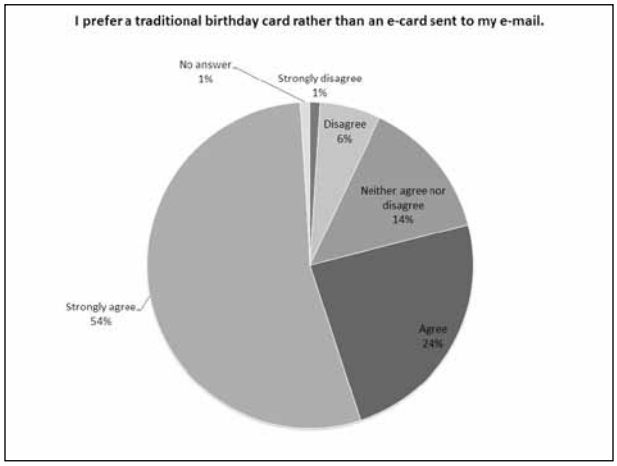

Figure 4

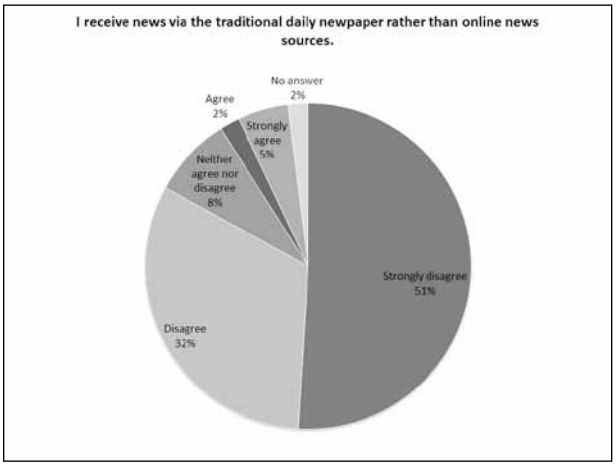

Figure 5

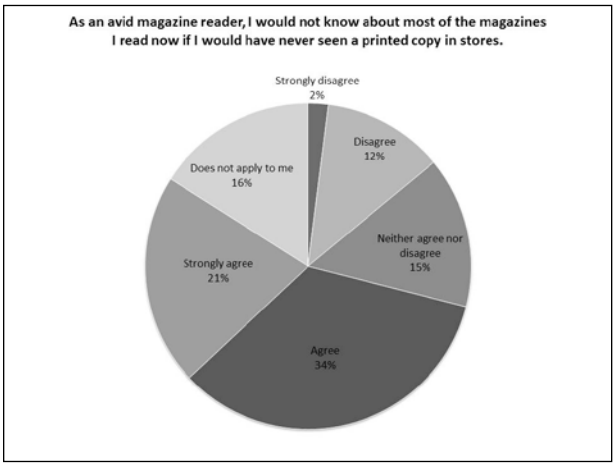

Figure 8

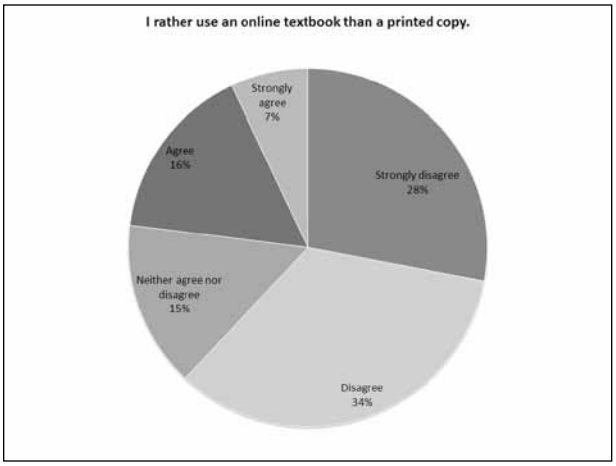

Figure 6

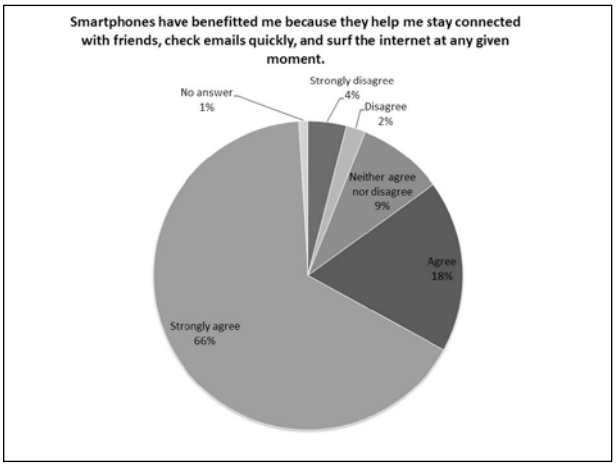

Figure 9

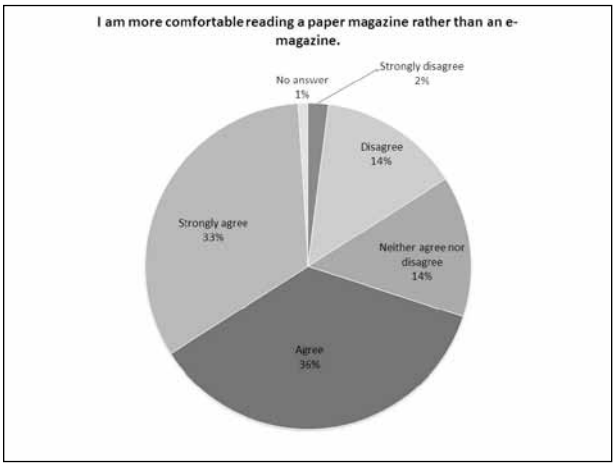

Figure 7

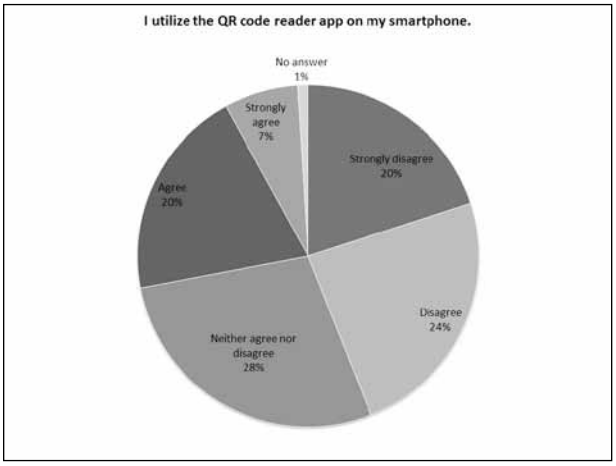

Figure 10

The Importance of Megapixels in Web Design

by Jessica Gann for Monika Zarzycka, M.S., M.Div. • University of Houston

The Megapixel Myth is the idea that more megapixels make images better. This is true to a certain degree with images to be printed, but only when they need to be printed with a high resolution at a very large size. In web design, images are purposefully reduced in size as much as is possible while maintaining image quality. This is to provide the fastest download time for the end user. Therefore, does the Megapixel Myth apply to images for use on the web? Will starting with more megapixels affect the final reduced image?

Images are one of the primary ways of communicating information and creating a site's sense of "place" in web design (Lynch & Horton, 2008). An image can communicate complex ideas and information that text alone cannot. Out of 21,500 web pages surveyed in 2007 for WebsiteOptimization.com, as a part of an eight-year study of the average web page, 91% used images (2011). This small-scale survey also found that the average aggregated image area of the average web page was 49,144 pixels, or a square image of 221 x 221 pixels. In a larger study of 4.2 billion pages, Sreeram Ramachandran of Google found that there were almost 30 unique images on the average web page (2010).

Digital images are made of pixels (picture elements). A megapixel (MP) is 1,000,000 pixels, and is a measurement of area or resolution. In 1998, Jon Pepper of *DigitalFocus* wrote a review of (then) brand-new one megapixel cameras, proclaiming 1,000,000 pixels as the "Holy Grail of digital photography". He also describes the resolution of images from older cameras as only enough for "onscreen viewing or very small printouts" (1998). This is still true today, because Google found the average size of an image on a web page to be 205.99KB (Ramachandran, 2010). This is close to the estimated size of a JPEG file at 90% quality and 24 bits per pixel from Pepper's Konica Q-M100 at its highest resolution of 1152 x 872 pixels (approximately 1MP) (Pepper, 1998) (Forret, n.d.).

Today, digital cameras are compared to each other by the number of megapixels contained in the imaging sensor. This number started in the late 1990s with a single megapixel cameras like those in Pepper's review, and by 2003 was up to 14MP with the Kodak DCS Pro 14N (Manes, 2003). For professional photographers, Chris Foresman of the site *Ars Technica* recommends higher megapixel cameras for the ability to print or crop large images without a loss of quality (2011). However, he mentions that most professionals are usually fine with a 12MP camera. For regular consumers, he says, "12MP is overkill" because their images are usually shared online via social media sites like Flickr or Picasa, where they are viewed at about half a megapixel (Foresman, 2011). He recommends that casual photographers invest in a 6-8MP camera with a good lens to save storage space and time editing. He also mentions that the size of the image sensor is not the only feature that affects a digital camera's quality (2011).

However, can everyday people tell the difference between a high-resolution image and a low-resolution image of the same thing? In 2007, David Pogue of the New York Times decided to try and expose the Megapixel Myth as a "big fat lie" once and for all with the first of two tests. His original test involved taking a 13MP image and adjusting the resolution in Photoshop to create an 8MP and a 5MP image. These images were then each printed at 16 by 24 inches, or at a poster size. When Pogue asked passersby to try and identify which image was the high-, medium-, and low-resolution version, only one person out of "several dozen" passed the test. When he tried a second test that involved cropping images from a 16.7MP camera down to a 10MP and a 7MP image, printing all three at 16 by 24 inches, and again asking passersby to identify which was which, only three out of around fifty people who tried could tell the difference. He concluded from his tests that "for the nonprofessional, five or six megapixels is plenty, even if you intend to make poster-size prints" (Pogue, 2007).

While Pogue's test makes sense in print, what about the web? There is a vast difference between appropriate print resolution and web resolution for images. In print the size of the image is static, while in web the resolution of an image varies based on the end-user's screen resolution setting (Webster, 1997). According to the 2007 Digital Image Submission Criteria Guidelines (DISC) for image submissions to publications, a high-resolution image to be printed at 11 by 17 inches should be 16MP* and at 300dpi (dots per inch) (IDEAlliance, 2007, p. 64). This image is 5100 x 3300 pixels, 4.5 larger than native display of the newest 27-inch iMac from Apple, at 2560 x 1440 pixels (Apple Inc., 2011). In order for the image to look similar to its printed size on the same iMac, which has a resolution of about 108ppi (pixels per inch), the image

would have to be reduced to 1836 x 1188 pixels, approximately 2.2MP (Forret, n.d.).

Traditional methods of optimizing images for the web include changing the resolution to either 72ppi or 96ppi, the minimum screen resolutions to expect from the end user, or by using compression (Webster, 1997, pp. 68-70). For the example above, the image would need even further reduction to display at the intended size, to approximately 1MP at 1224 x 792 pixels (Forret, n.d.). The majority of web images are (from highest to lowest): GIFs, JPEGs, or PNGs (Website Optimization, LLC., 2011). These are the most common file formats for web images because of their ability to be compressed (Lynch & Horton, 2008). Web images are usually compressed to "the smallest file size that still looks good" to provide faster download speeds to users (2008). Keeping file sizes as low as possible has always been important to web design, because there are still users browsing on dial-up connections at around 56KB per second instead of broadband (Website Optimization, LLC., 2011).

Image resolution for the web may be changing in the future from the traditional 72-96ppi. Recent displays, such as the iMac, are already at greater native resolutions than 96ppi (Apple Inc., 2011). For web design, this poses size issues, as pointed out by Chris Coyier of CSS-Tricks (2008). Both he and Dave Hyatt of *Surfin' Safari* discuss "resolution independence" and the potential solutions in development with Scaleable Vector Images (SVG) and the magnification of CSS pixels (Hyatt, 2006). The Megapixel Myth does not affect vector images because they do not have pixels. The idea behind scaling CSS pixels is that it is a relative measurement and it can be remapped to "device" pixels (Hyatt, 2006). Bitmap images are defined by pixels, and have trouble scaling up because the pixels become visible. The scaling of CSS pixels to device pixels may not affect images if they are scaled to their viewing size from the lower-resolution display.

Does the number of pixels in an image make it better? More pixels can help photographers who make very large prints, but they also increase the file size, the amount of storage space necessary, and the time an image takes to download. The Megapixel Myth may not be true for today's web sites because of the current screen display capabilities, but it is uncertain if it will change in the future.

* According to the DISC article, they no longer calculate megapixels based on the 1,024 ratio of measurement. Instead, megapixels are calculated using the "modern" ration of 1,000. (IDEAlliance, 2007, p. 64). The megapixel calculator used for this paper uses the 1,024 ratio, approximating this image to be 16.8MP. (Forret, n.d.).

References

Apple Inc. (2011, May 3). *iMac - Compare the 21.5- and 27-inch iMac.* Retrieved April 1, 2012, from Apple: http://www.apple.com/imac/specs.html

Coyier, C. (2008, Nov. 3). *High DPI Monitors, Resolution, Independance, The Web and You.* Retrieved April 1, 2012, from CSS-Tricks: http://css-tricks.com/high-dpi-monitors-resolution-independance-the-web-and-you/

Foresman, C. (2011, May). *Why we've reached the end of the camera megapixel race.* Retrieved April 1, 2012, from Ars Technica: http://arstechnica.com/gadgets/news/2011/05/why-weve-reached-the-end-of-the-camera-megapixel-race.ars

Forret, P. (n.d.). *Megapixel Calculator - digital camera resolution.* Retrieved March 26, 2012, from web.forret.com: http://web.forret.com/tools/megapixel.asp

Hyatt, D. (2006, April 21). High DPI Web Sites. Retrieved April 1, 2012, from Surfin' Safari: http://www.webkit.org/blog/55/high-dpi-web-sites/

IDEAlliance. (2007, May). DISC 2007 Guidelines and Specs. Retrieved October 14, 2011, from IDEAlliance: http://www.idealliance.org/specifications/disc/specifications

Johnston, M. (2009, April 6). *Is What The World Really Needs a Really Good 3-MP Digital Camera.* Retrieved March 20, 2012, from The Online Photographer: http://theonlinephotographer.typepad.com/the_online_photographer/2009/04/is-what-the-world-needs-a-really-good-3mp-digital-camera.html

Knight, D. (2008, January 10). *Busting the Megapixel Myth*. Retrieved March 16, 2012, from LowEndMac.com: http://lowendmac.com/digigraphica/08dg/busting-the-megapixel-myth.html

Lynch, P. J., & Horton, S. (2008). Web Style Guide: Basic Design Principles for Creating Web Sites. *3rd*. New Haven, CN: Yale University Press.

Manes, S. (2003, May 12). Megapixel Madness. *Forbes, 171*(10), p. 134.

Oldano, R. (2000, April). One-Megapixel Digital Cameras. *Macworld, 17*(4), p. 44.

Pepper, J. (1998, May). Megapixels: The digital Holy Grail is within reach. *Presentations, 12*(5), pp. 39–40.

Pogue, D. (2007, Feb. 8). *Breaking the Myth of Megapixels.* Retrieved March 18, 2012, from The New York Times: http://www.nytimes.com/2007/02/08/technology/08pogue.html

Ramachandran, S. (2010, May 26). *Web metrics: Size and number of resources - Make the Web Faster*. Retrieved April 1, 2012, from Google Developers: https://developers.google.com/speed/articles/web-metrics

Rockwell, K. (2008). *The Megapixel Myth*. Retrieved March 21, 2012, from kenrockwell.com: http://www.kenrockwell.com/tech/mpmyth.htm

Website Optimization, LLC. (2008, May 02). *The Average Web Page - Preliminary Results*. Retrieved April 1, 2012, from OptimizationWeek.com: http://www.optimizationweek.com/reviews/average-web-page/

Website Optimization, LLC. (2011, June 29). *Average Web Page Size Septuples Since 2003*. Retrieved April 1, 2012, from Websiteoptimization.com: http://www.websiteoptimization.com/speed/treak/average-web-page/

Webster, T. (1997). *Web Designer's Guide to Graphics: PNG, GIF & JPEG.* Indianapolis, IN: Hayden Books.

Manuscript Guidelines

Eligibility for Publication

Members of the International Graphic Arts Education Association, or students of IGAEA members, may publish in the *Visual Communications Journal*.

Audience

Write articles for educators, students, graduates, industry representatives, and others interested in graphic arts, graphic communications, graphic design, commercial art, communications technology, visual communications, printing, photography, desktop publishing, or media arts. Present implications for the audience in the article.

Types of Articles

The *Visual Communications Journal* accepts four levels of articles for publication:

1. Edited articles are accepted or rejected by the editor. The editor makes changes to the article as necessary to improve readability and/or grammar. These articles are not submitted to a panel of jurors. The decision of the editor is final.
2. Juried articles are submitted to the editor and are distributed to jurors for acceptance/rejection. Juried articles are typically reviews of the literature, state-of-the-art technical articles, and other nonempirical papers. Jurors make comments to the author, and the author makes required changes. The decision of the jurors is final.
3. Refereed articles are submitted to the editor and are distributed to jurors for acceptance/rejection. Refereed articles are original empirical research. Jurors make comments to the author and the author makes required changes. The decision of the jurors is final.
4. Student articles are submitted by IGAEA members and are accepted/rejected by the editor. These articles are not submitted to a panel of jurors. The editor's decision is final. Please be aware that poorly written student papers will be rejected or returned for editing.

Submittal of Manuscripts

All manuscripts must be received by the editor no later than December 15th to be considered for the spring *Journal* or by June 15th to be considered for the fall *Journal*. Include digital 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, and daytime phone number with your materials. E-mail all materials to the editor (address shown below).

Acceptance and Publication

If your article is accepted for publication, you will be notified by e-mail. The *Visual Communications Journal* is published and distributed twice a year, in the spring and in the fall. Printed copies are mailed to IGAEA members. A PDF version of the *Journal* is published online at www.igaea.org.

Notice

Articles submitted to the *Journal* cannot be submitted to other publications while under review. Articles published in other copyrighted publications may not be submitted to the *Journal*, and articles published by the *Journal* may not be published in other publications without written permission of the *Journal*.

Submit All Articles and Correspondence to:
Dan Wilson, dgwilso@ilstu.edu
or check www.igaea.org for contact information for the IGAEA First Vice-President.

See following page for style guidelines

Manuscript Form and Style

- Prepare manuscripts according to the APA style, including the reference list.
- List your name and address on the first page only. Article text should begin on the second page.
- Provide a short biography for yourself that can be used if the article is accepted for publication.
- All articles must be submitted in electronic form on a CD-ROM or as an email attachment.
- Submit a Microsoft Word document, maximum of 10 pages (excluding figures, tables, illustrations, and photos). Do not submit documents created in page-layout programs.
- Word documents must have been proofread and be correct.
- Call out the approximate location of all tables and figures in the text. Use the default style "Normal" on these callouts. The call-outs will be removed by the designer.
- Use the default Word styles only. Our designer has set up the page layout program styles to correspond to those style names.
  - Heading 1
  - Heading 2
  - Heading 3
  - Normal

Graphics

- Be sure that submitted tables and other artwork are absolutely necessary for the article.
- Write a caption for each graphic, include captions in a list at the end of your Word document.
- Electronic artwork is preferred and should be in PDF or TIFF format.
- Send all artwork files and hard copies of these files with your submission.

Tables

- Set up tables in separate documents, one document for each table.
- Do not attempt to make it "pretty." Use the default Word style "Normal" for all table text. Do not use any other formatting.
- Do not use hard returns inside the table ("enter" or "return").
- Get the correct information into the correct cell and leave the formatting to the designer.
- Tables will be formatted by the designer to fit in one column (3.1667" wide) or across two columns (6.5" wide).

Artwork

- Scan photographs at 300 ppi resolution.
- Scan line drawings at 800 ppi resolution.
- Screen captures should be as large as possible.
- Graphics should be sized to fit in either one column or across two columns.
  - One column is 3.1667" wide, two columns are 6.5" wide.
  - Graphics may be larger than these dimensions, but must not be smaller.