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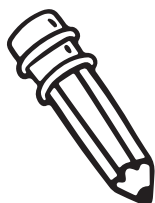
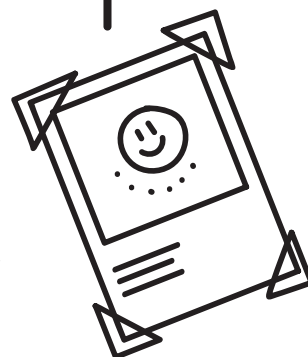
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LETTER FROM THE PRESIDENTS

Dear Readers,



Our names are Madison Montgomery and Griffin Sanders. We are both Graphic Communication majors at Clemson University. Working with the team this year has been an exceptional experience, and we have all worked incredibly hard to deliver this journal to you. We hope you find our work to be enjoyable and informative as you review our notes on the different printing processes taught at Clemson and read our beloved professor's research.



The team greatly appreciates all this department has helped us to achieve and we are very thankful to the program staff for preparing us so that we are able to present this journal to you.

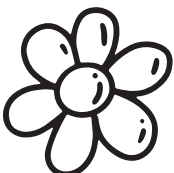
The team wants to extend a special thank you to Dr. Bridges, who oversaw us. As well as a thank you to the Graphic Communications graduate students, professors, and staff who helped us operate the equipment in the lab.



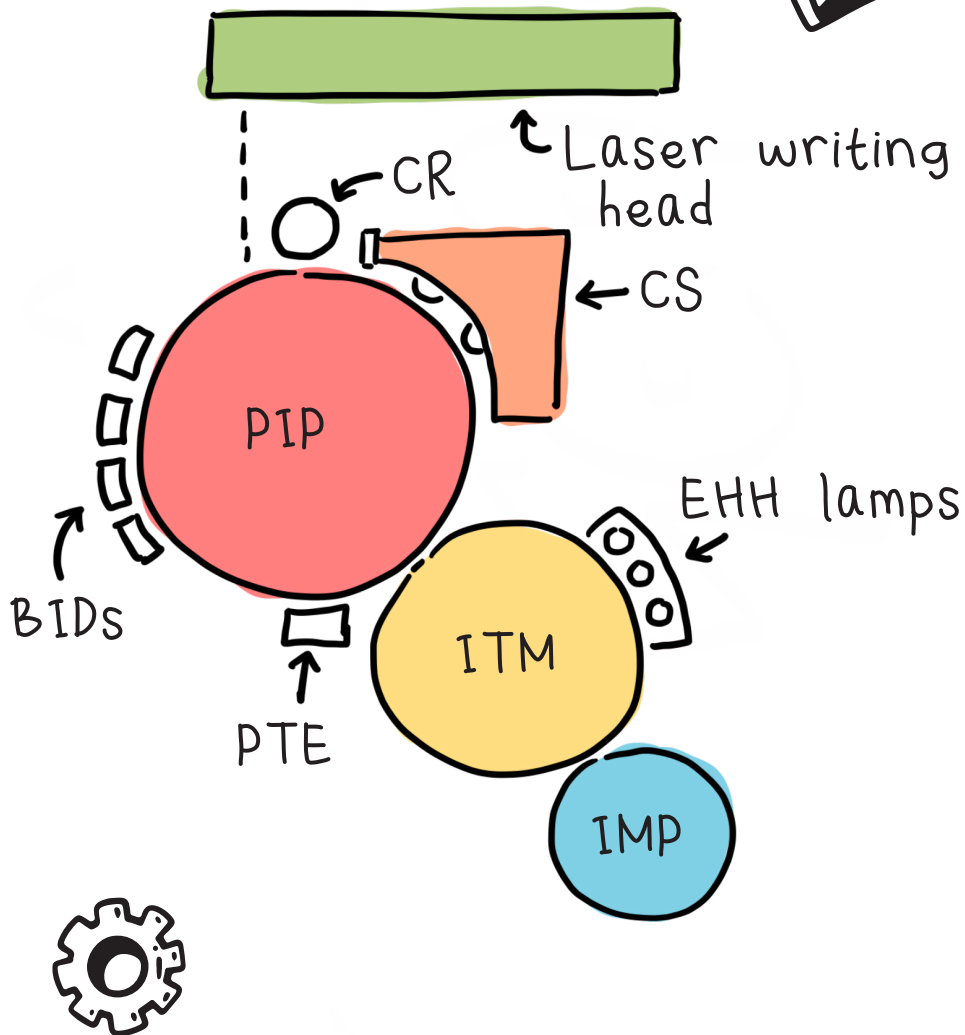
We are very grateful to Dr. Bridges, Dr. Walker, Dr. Smith, Dr. Blue, and Forrest Zach for allowing us to use their research.



We hope you enjoy our journal.



A LOOK INSIDE THE HP INDIGO



What does everything do?

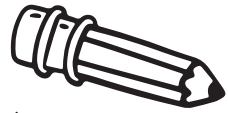
Laser writing head:

The laser head is involved in exposing the PIP by use of laser beams and neutralizing the charges in the image area.



CR (Charge Roller):

This cylinder is made of metal and conductive rubber and absorbs toner evenly to eliminate residual potential.



PIP (Photo Imaging Plate):

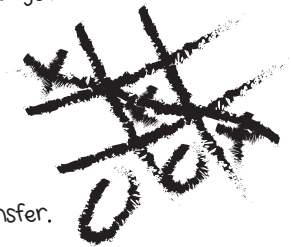
The PIP is exposed by the laser head and is the plate that holds the printed image.

BIDs (Binary Ink Developers):

The BIDs are involved in image development. They roll a thin layer of electroink onto the PIP's surface.

PTE (Pre Transfer Erase):

The PTE has to do with image transfer, and discharges any remaining charged areas on the PIP.



EHH lamps:

These lamps help to keep the ink at the perfect viscosity for transfer.

ITM (Intermediate Transfer Member):

This cylinder receives the first transfer of the final image and in turn transfers the image onto the substrate.

IMP (Impression Roller):

This cylinder assists in the final transfer of the image. The proximity between IMP and ITM are essential in image transfer.



Meet:
DR. CARL BLUE

Dr. Carl Blue has always had a passion for teaching graphics.

"It was always there, in my mind, how I would love to work here [Clemson]."

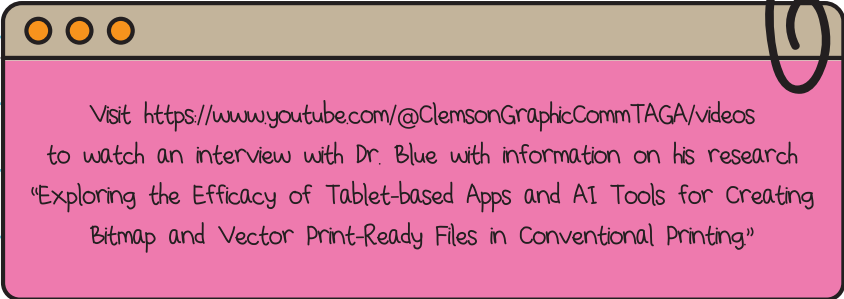
When an opportunity arose to come to Clemson, he knew it would be a challenge and was eager to take it on.

Dr. Blue views everything he does as problem solving.

"How can I create something within constraints?" He believes that learning through failure is important in order to succeed.



One thing Dr. Blue hopes students gain from his class is confidence; the confidence to understand your own knowledge and to do something with it. One piece of advice that Dr. Blue has for students' is to not let yourself be the one to say no, and to take on opportunities and except challenges.



Visit <https://www.youtube.com/@ClemsonGraphicCommTAGA/videos> to watch an interview with Dr. Blue with information on his research "Exploring the Efficacy of Tablet-based Apps and AI Tools for Creating Bitmap and Vector Print-Ready Files in Conventional Printing"

EXPLORING THE EFFICACY OF TABLET-BASED APPS AND AI TOOLS FOR CREATING BITMAP AND VECTOR PRINT-READY FILES IN CONVENTIONAL PRINTING

C.N. Blue, Associate Professor, Department of Graphic Communications,
Clemson University, SC.

Keywords: Tablet Applications (Apps), Artificial Intelligence (AI), Print-Ready, Color
And Process Management.



Abstract

This paper and presentation aim to explore the increasing use of tablet-based platforms and AI tools in the classroom for graphic design and the challenges that arise with producing print-ready files. The goal is to identify the strengths and limitations of these devices and apps, such as Adobe Illustrator, Adobe Photoshop, Procreate, and others on tablet apps, and AI image generation tools like popular Midjourney and Dall-e, in producing graphics for conventional printing processes. The paper will also explore possible solutions for enhancing and converting tablet-generated graphics to meet pre-press standards and provide examples of where adjustments are needed. The rise of tablet-based platforms raises the question of whether this marks the decline of traditional laptops and graphic design applications.



Background

Are tablet-generated or AI-produced digital graphics print-ready, or do they necessitate further image management for developing high-quality print-ready process color separations, tints, and spot-color jobs, including color-trapping capabilities. How can professionals encourage the proper utilization of these tools? These inquiries steer this investigation.

Observations

Recently, tablet-based raster and vector graphic design apps have gained popularity in classrooms and among students for creating print production graphics. Occasionally, students employ these robust devices and their accompanying styluses for crafting initial sketches and thumbnails for their projects. However, lately, tablet-based products have been covertly incorporated into print preparation workflows, lacking color trapping requirements essential for traditional print processes such as screen-printing, offset, and flexography applications. One aim is to facilitate the use of these tablet applications alongside traditional computer graphic production tools for conventional process print-ing. Some tablet-based graphic applications can work in both RGB and CMYK color modes [19], either in raster or vector formats, including more established Adobe products that offer scaled-down versions of Illustrator and Photoshop as part of their suite of Creative Cloud applications through their licensing[1].



Case Study

An assignment was designed as a case study to evaluate students' competencies and retention of knowledge based on previously covered coursework. This assessment aimed to establish a general baseline for their progress moving forward.

Assignment Instructions:

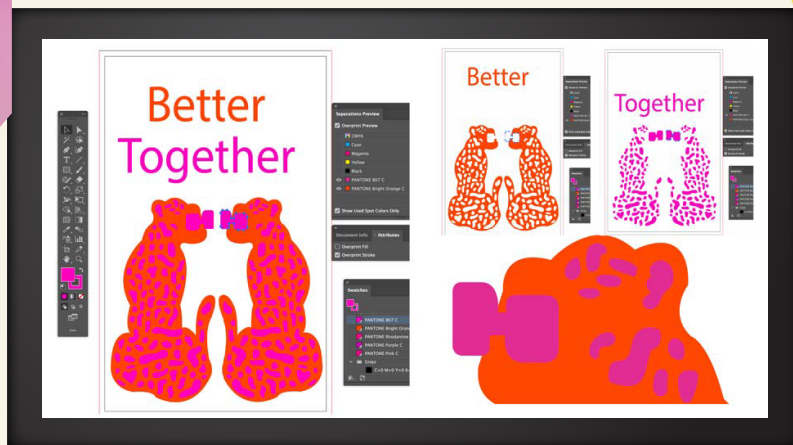


- ①. Create a poster for offset lithography using an 11x17 vertical layout, focusing on any topic or theme.
- ②. Limit the design to 2-3 named spot colors and tints.
- ③. Properly create spot-color separations and apply color trapping where necessary.
- ④. Produce three samples of sketch work, using either pencil and paper or a tablet for generating sketches. (Note: We are exploring the potential of tablets for student work.)
- ⑤. Submit the poster as a PDF and an Adobe Illustrator native file.

After evaluating the submitted projects, it became apparent that this was an opportune moment to address their pre-existing knowledge of software usage, spot color implementation, and color trapping techniques. After reviewing the work of all 16 students, a few key insights emerged, prompting further exploration and discussion. Although most students successfully used spot colors, many struggled with creating effective color traps. Additionally, about half of the class submitted files containing

elements that were difficult to interpret based on the provided native file information alone. These unique design features seemed to indicate the use of tablet applications and styluses, resulting in a more organic look compared to traditional hand-drawn sketches. This discovery led to the hypothesis that students were transferring their electronic sketches to Adobe desktop applications, such as Illustrator, to create their final submissions. The varying approaches to preprocess workflow in these projects offered an ideal opportunity for a teachable moment. By addressing these observations, educators can guide students to improve their understanding of software, color management, and digital design techniques, ultimately enhancing their overall skill set. Figures 1- 5 provide some of these discoveries.

Figure 1:



Example of a two-spot color submission. Spot colors named and separated in preview.



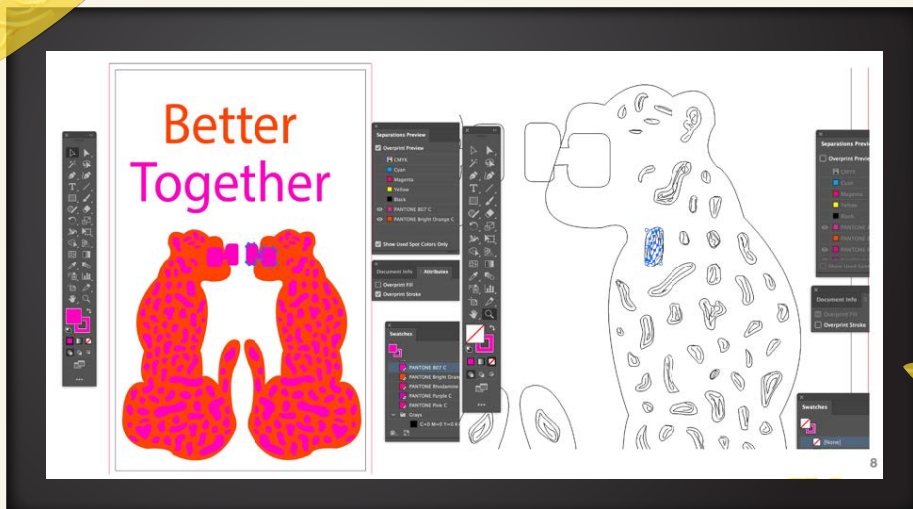
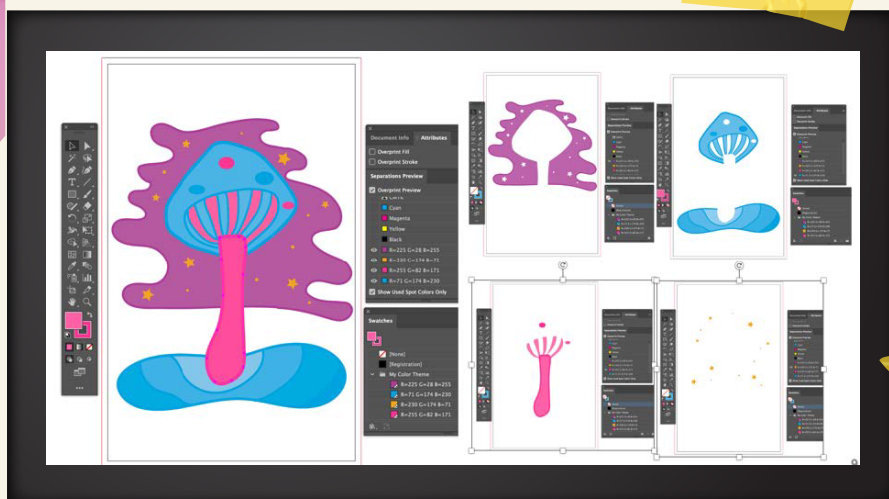


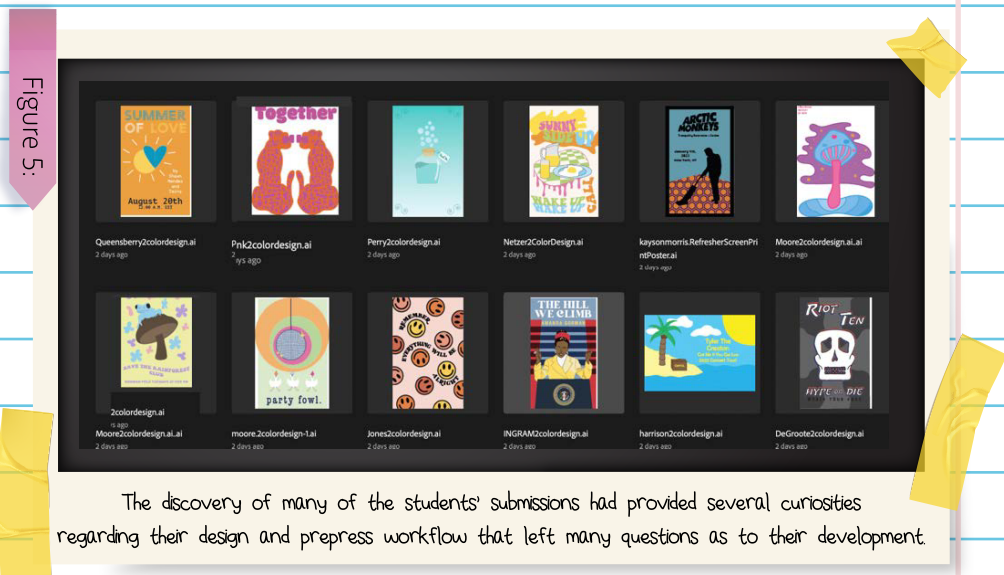
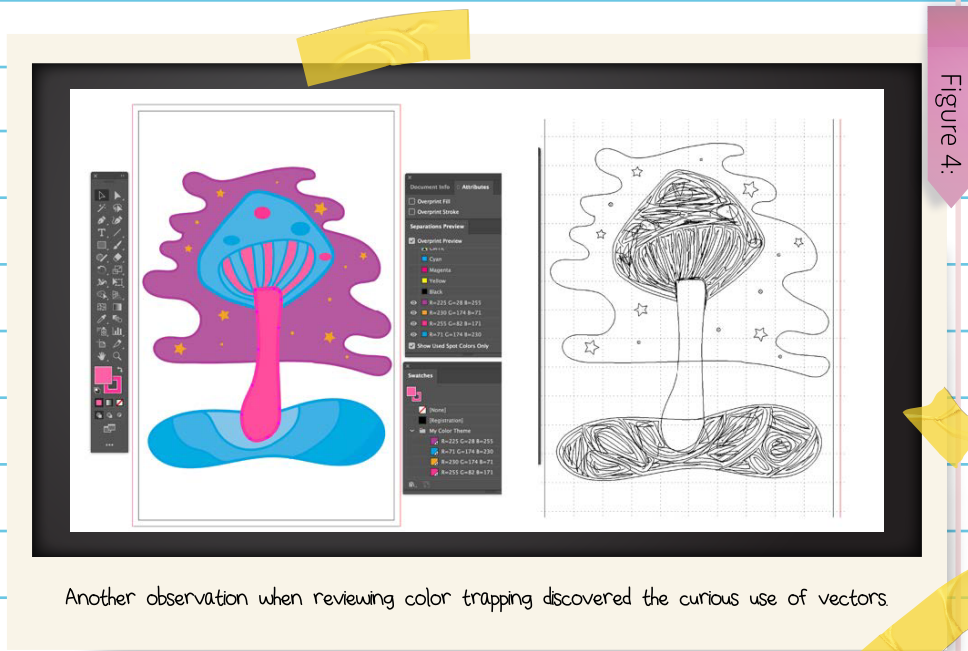
Figure 2:

In reviewing for color trapping, curious applications of vectors was observed.

Figure 3:



Another example of an artifact submission, four spot colors named and separated

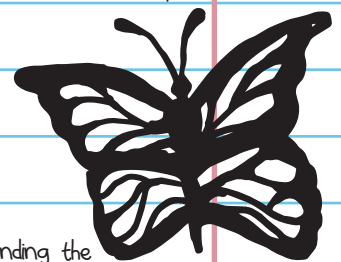


Teachable moment

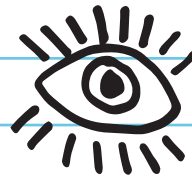
Upon evaluating the initial assignments, an exciting opportunity presented itself to dive deeper into the students' submissions and address potential areas for improvement, such as spot color assignment and color trapping in Illustrator. Additionally, this exploration allowed for the discovery of new techniques used by the students who submitted tablet-based graphics. Interestingly, some of these vector-based sketches were created using Adobe Illustrator for iPad, while others utilized PROCREATE, a raster-image sketching tool. Approximately half of the class employed tablet-based tools for rendering their sketches, later tracing the raster images in Adobe Illustrator on their laptops. To gain a better understanding of students' design processes and the tools they use, it was decided to introduce a writing assignment focused on their workflow. This approach would enable educators to anticipate the use of various software and tools, addressing their limitations in prepress development while simultaneously encouraging creative exploration. By emphasizing discovery and addressing workflows, this experience fosters a collaborative learning environment, empowering students to develop their skills and adapt to an ever-evolving world of design technology.

Introduction

The adoption technology theory is a framework for understanding the psychological and social factors that influence the adoption of new technologies [22]. According to Rogers (1995), individuals are more likely to adopt new technologies if they perceive them to be useful, easy to use, and compatible with their existing practices and values [22]. This theory suggests that the adoption of new technologies is a process that



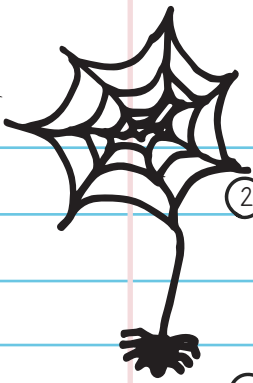
occurs over time, with individuals moving through various stages. Additionally, students and youth have been identified as key drivers in the early adoption of technology due to their curiosity and willingness to experiment with new technologies [12]. According to a study conducted by the International Journal of Emerging Technologies in Learning [11], "students are more likely to adopt new technologies than other groups, due to their exposure to technological advancements in their schools, colleges, and universities" [12]. As such, it is essential for educational institutions to provide the necessary resources to facilitate early adoption of technology to keep up with the rapidly changing technological landscape. By recognizing the crucial role of students and youth in the adoption of technology, educators and institutions can remain competitive in the global market [12].



Methodology

The increasing use of tablet-based platforms in the classroom for graphic design raises questions about their capabilities in producing print-ready files for conventional printing processes. This actuality proposes the question, are tabletbased platforms a viable alternative to traditional laptops and graphic design applications in producing print-ready graphics for conventional printing processes? A methodology for this objective includes:

1. Investigation of the capabilities of tablet-based platforms in comparison to traditional laptops and graphic design applications in producing print-ready graphics.



②. Analysis of the standards for producing quality pre-press

files for production and the ability of tablet-based platforms to meet these standards.

③. Identification of possible solutions for enhancing and

converting tablet-generated graphics to meet pre-press standards.

④. Examination of examples of where tablet-generated

graphics are being produced yet need adjustments to meet the standards of outputting film for conventional printing processes.

⑤. Discussion of popular tablet apps, such as Procreate, Adobe Photoshop Sketch,

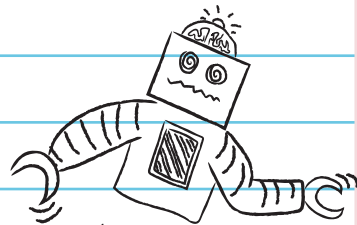
Sketchbook, Adobe Illustrator Draw, and more, and their capabilities in producing print-ready graphics.

The findings of this research will provide insight into the strengths and limitations of tablet-based platforms in producing print-ready graphics for conventional printing processes and identify areas for improvement. This will inform the decision-making process for graphic designers and students in choosing the appropriate tools for their projects.

Ipap Pro Tablet

Apple doesn't usually release exact sales numbers for specific models of their devices, but they do report overall revenue and unit sales for their product categories in quarterly financial reports [24]. The iPad is part of the "iPad, Mac, and Wearables/Home/Accessories" category in these reports, so we don't have a way to know the exact number of iPad Pro units sold [24]. As of the end of the first quarter of 2022, Apple had sold over 450 million pads in total, including all models of the iPad [24]. However, according to Apple's Q4 2021 financial results, the iPad had a record-breaking

quarter with \$9.1 billion in revenue, which represents an increase of 21% over the same quarter in the previous year. This suggests that the iPad, including the iPad Pro, continues to be a popular device among consumers [24]. iPads have transformed digital art and design by simulating the experience of drawing on paper, thanks to SAW technology that uses ultrasonic waves for precise touch input detection. Active electrostatic (ES) stylus pens further enhance this experience with their high accuracy, passive technology, and compatibility with any device supporting pen input[11].



Surface Acoustic Wave (SAW)

In the article entitled, *Generation of Drawing Sensation by Surface Acoustic Wave Tactile Display on Graphics Tablet* by authors Amon, Akasaki, & Mizuno, in their 2012 Journal *SICE Journal of Control, Measurement, and System Integration*, this paper presents a pen interface that generates tactile sensations using a surface acoustic wave tactile display, allowing for the sensation of drawing with a charcoal [2]. The interface can be combined with a graphics tablet to generate both visual information and tactile sensation dynamically. The paper proposes a method of controlling the sensation using an m-sequence random number and presents measurement and FFT analysis results of the pen vibration with and without this control [2].

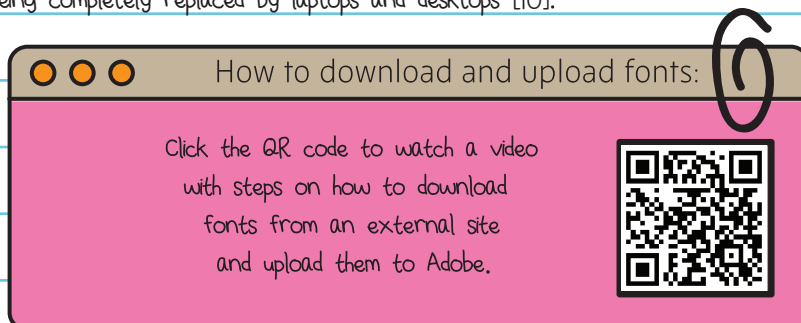
Styluses – Pressure Curves and Sensitivity Settings

A capacitive stylus pen uses electrostatic charge to create a stylus tip that can be used on *capacitive touch screens*. The tip of the pen is made of a conductive material, such as metal, that can hold a charge. When the tip of the pen touches the

screen, the charge is transferred to the screen, which allows the user to interact with the screen. An active ES stylus is a pen that senses the capacitance of an object in front of it by using an *electrostatic capacitive stylus tip*. As a result of this capacitance, the pen's movement can be controlled. There is no need for power to operate the pen because the technology is passive. That means that it can be used on any device with a pen input, including a computer, phone, or tablet [11].

Tablets vs laptops

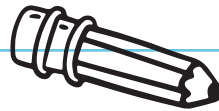
Tablet computers are not completely replacing standard laptops and desktop computers, as each has its own specific use case and advantages [9]. Tablets are generally more portable, have longer battery life, and are better for consuming media, while laptops and desktops offer more power, storage, and are better for productivity tasks [25]. However, tablets have come a long way in terms of computing power and can perform many tasks that were once only possible on laptops and desktops. For example, high-end tablets such as the iPad Pro can handle tasks like video editing, graphic design, and even programming [26]. According to a report by Statista, global tablet shipments have been declining in recent years, while desktop and laptop shipments have remained relatively stable. However, this does not necessarily indicate that tablets are being completely replaced by laptops and desktops [10].



Tablet Applications

Procreate

Procreate is a graphic design app that is best used on a canvas with dimensions of 1920 × 1080px and a DPI of 72. This canvas size will give you a full screen view with an aspect ratio of 16:9 [6]. The app also requires a minimum of 4GB of RAM to function well and make the most of your canvas size and layer limit. Procreate offers over 200 handcrafted brushes, complete color control, fast performance, and various other features such as *Facepaint* [19, 20]. The industry standard for best print quality in Procreate is 300 PPI/DPI. However, depending on the printed size of your piece and the viewing distance, a lower DPI/PPI may still look acceptable. It is recommended to use no lower than 125 DPI/PPI for best results [5].



Procreate is a raster-based app [19]. Procreate is only capable of working with pixels and does not have the ability to create vector graphics, you would need to convert your lettering into a vector format using another software [19x]. Professionals use Procreate primarily for illustration, and it is considered a more affordable alternative to Adobe Photoshop [6]. Some of the benefits of Procreate include its highly responsive brush technology, intuitive interface with customizable tools and canvas sizes, and the ability to record videos. However, it has a steep learning curve for those without digital drawing experience and its features are optimized for use with the Apple Pencil and iPad Pro only [14x]. Procreate has a one-time fee and allows you to store the software on your device [6].

When using Procreate for printing, it is important to convert the color format from RGB to CMYK to achieve the best results. Keep in mind that some colors may appear less vibrant in CMYK. Knowing the physical dimensions and proportions of the final product is crucial when setting up the canvas. It is also important to consider bleed for professional printing jobs. Setting the resolution to 300dpi or 600dpi when creating the canvas will ensure that the artwork contains enough detail and avoid pixelation. It is important to do this at the initial stage to maintain the quality of the image [13].

Procreate can handle the same level of resolution as other programs like Photoshop. For most printing needs, such as printing on an archival quality inkjet, Procreate is sufficient. However, for larger, higher resolution prints and four-color halftone process printing, Photoshop may be necessary. It is important for artists to educate themselves on image raster and output methods for reproducing their work. JPEG should not be used for final output as it sacrifices image quality for file size. Instead, artists should export in PNG or Procreate's PSD export option, which are lossless formats that save the image as drawn. Artists can import their work into other apps that give them control over printer settings or print directly from the iPad using AirPrint or Wi-Fi-connected printer apps [19, 20].

Adobe Illustrator on iPad



Adobe Illustrator on iPads is a powerful tool for graphic designers and students, offering a variety of capabilities for producing prepress graphics [1]. Key features include seamless integration with Adobe Creative Cloud, which allows users to

access files and work across multiple devices, ensuring a smooth transition between iPad and desktop versions [1]. The app provides comprehensive vector drawing and editing tools for creating precise, scalable graphics suitable for prepress applications [1]. It supports both RGB and CMYK color modes, adheres to industry standards for color management, and offers robust layer management capabilities for efficient organization and control of designs [1]. Adobe Illustrator on iPads also provides various export options, such as PDF and native Illustrator formats, which are commonly used in prepress workflows [1]. Compatibility with Apple Pencil enables users to sketch and create graphics with precision and ease, like traditional pencil and paper methods [6]. Adobe consistently updates and enhances the app, ensuring access to the latest features and tools for prepress graphic creation [1]. However, it is important to note that some features may be limited compared to the desktop version [1]. Despite this, the iPad version remains a valuable tool for creating and editing graphics on the go, supporting the development of print-ready designs [1]. Below in Figure 6 and 7 outlines some of the attributes of Adobe Illustrator on iPads.



Transitioning from the desktop Adobe Illustrator to the iPad version may be challenging due to the touch-based interface. However, the familiar core features and tools, along with Adobe's efforts to maintain consistency, make adaptation easier. Resources like tutorials and guides, as well as Apple Pencil compatibility, help users become comfortable with the iPad version. Over time, proficiency increases, allowing users to effectively utilize the app for creating prepress graphics and other design projects.

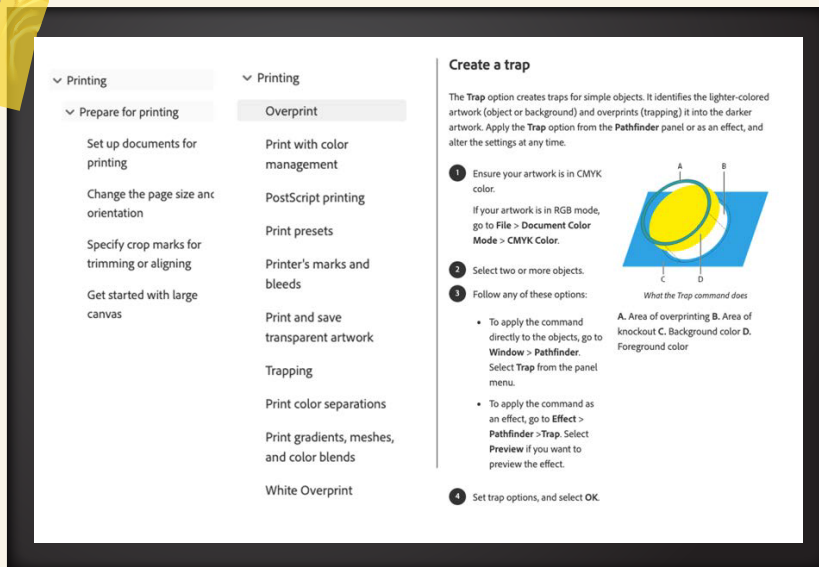
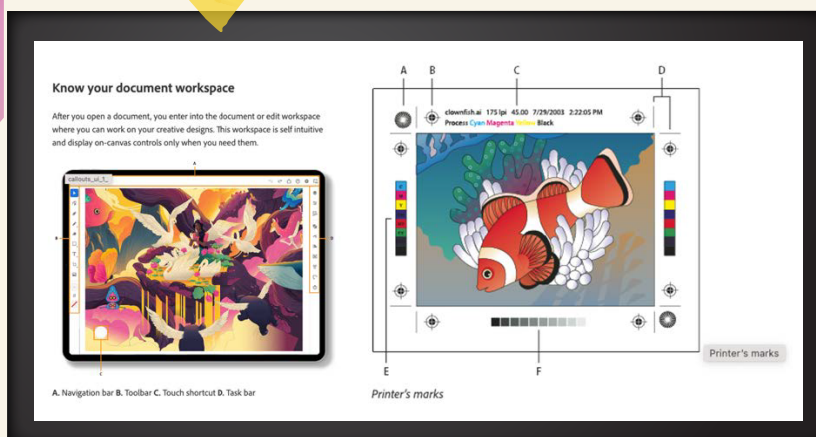


Figure 6:

Printing attributes and abilities to create a color trap on the Adobe Illustrator on iPads

Figure 7:



Adobe Illustrator on iPads' interface and functions differ from those of the desktop application and presents a dissimilar learning curve to master.

Procreate vs. Illustrator

Procreate and Illustrator are distinct design software programs catering to different creative needs. Procreate excels in digital art and illustrations, while Illustrator is better suited for graphic design and complex designs [20]. Illustrator is more expensive and creates infinitely scalable vector images, while Procreate, exclusive to iPads and iPhones, produces raster images [14]. Although Procreate has a simpler interface, Illustrator's complexity can overwhelm beginners. The choice between the two depends on personal preferences and the specific design work, with Illustrator being superior in graphic design and Procreate excelling in life-like artmaking [1].



Artificial Intelligence

Artificial intelligence (AI) is a rapidly evolving field of computer science that focuses on developing intelligent machines capable of performing tasks that typically require human intelligence [27]. It encompasses various subfields, including machine learning, natural language processing, computer vision, and robotics [27]. AI systems are designed to learn from data, adapt to new inputs, and perform human-like tasks such as problem-solving, pattern recognition, and decision-making [27]. The development of AI has revolutionized numerous industries- from healthcare to finance, enabling machines to assist humans in various tasks and significantly improve efficiency and productivity [27]. As AI continues to advance, it promises to further transform our world and the way we interact with technology [27].

AI Text-to-Image Generation

Text-to-image generation is a field of research that involves generating images from textual descriptions. The process of text-to-image generation involves encoding textual input into a format that can be used to generate an image [21]. One of the popular techniques used for text-to-image generation is the use of generative adversarial networks (GANs) [23]. GANs consist of two neural networks, a generator and a discriminator [23]. The generator takes in the textual input and generates an image while the discriminator evaluates the quality of the generated image. Through a process of trial and error, the generator learns to produce more realistic images [23]. Other techniques used for text-to-image generation include variational autoencoders (VAEs), attention-based models, and language-guided image synthesis.

Text-to-image generation has a variety of applications, including art and design, e-commerce, and gaming [8]. However, the field is still evolving, and there are challenges to overcome in terms of generating high-quality and diverse images [21].

AI Image Generators (Identified as used by students in this research)

DALL-E (stylized as DALL·E) and DALL-E 2 are deep learning models developed by OpenAI (ChatGPT) to generate digital images from natural language descriptions, called "prompts" [7]. In early November 2022, OpenAI released DALL-E 2 as an API, allowing developers to integrate the model into their own applications [7]. Microsoft unveiled their implementation of DALL-E 2 in their Designer app and Image Creator tool included in Bing and Microsoft Edge [18]. Microsoft Confirms Its \$10 Billion Investment Into ChatGPT, Changing How Microsoft Competes With Google, Apple And Other Tech Giants [18].

Midjourney is an AI image generation tool that take inputs from a human (usually through text prompts and parameters, but also other images) and uses a machine learning algorithm trained on a huge amount of image data to produce unique images [24]. Like most machine-learning models, Midjourney can be a bit of a black box. Midjourney was founded by David Holz, co-founder of Leap Motion. It first entered open beta on July 12, 2022 [24]. However, on March 14, 2022, the discord server launched with a request to post high-quality photographs to Twitter/Reddit for system's training. Copyright AI - The USCO initially granted the copyright as though Midjourney were no different than other digital illustration tools [15]. The decision to reverse the copyright stems from the rule that only works created by humans can be copyrighted [15].

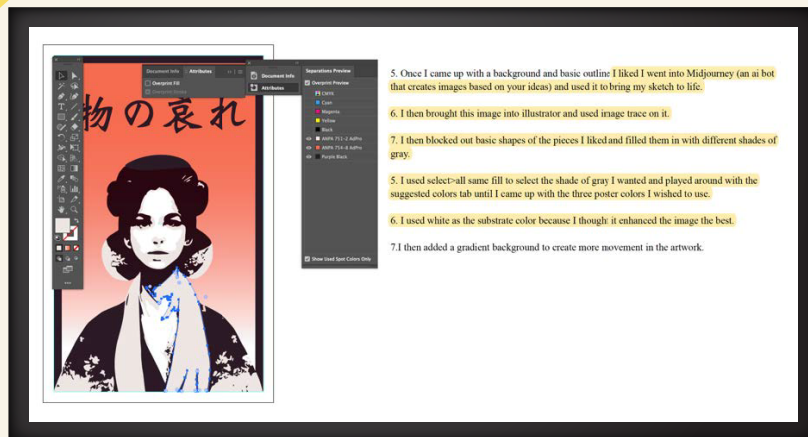


Figure 8:

Student identified the use of Midjourney for ideation image generation on the assign. The work was then process into a vector file in Illustrator.

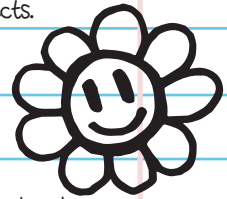
Top Five AI image generators

Several AI-powered applications have emerged, offering a variety of functionalities and catering to different user needs. *Jasper Art* is considered the best overall AI application, providing an exceptional user experience and a wide range of features. *Canva*, an AI image editor, stands out for its ability to enhance and create visually stunning graphics with ease. For those seeking a free option, *Picsart* offers numerous editing tools and capabilities without the need for a subscription. *Photosonic* is known for its user-friendly interface, making it the easiest AI application to use for beginners and experts alike. For mobile users interested in AI-generated selfies, *Lensa* AI offers a dedicated app that delivers high-quality, realistic results. These AI applications showcase the potential of artificial intelligence to transform the way we create and interact with digital content [27].

Findings

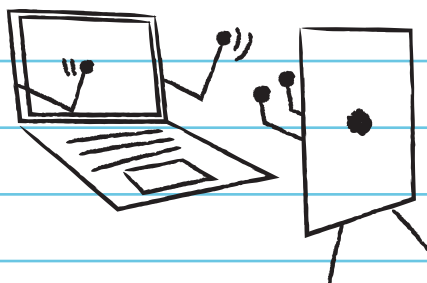
The research examined the viability of tablet-based platforms as an alternative to traditional laptops and graphic design applications for producing print-ready graphics for conventional printing processes. It compared the capabilities of tablets to laptops, analyzed the ability of tablets to meet pre-press standards, identified possible solutions for enhancing tablet-generated graphics, and examined instances where adjustments were needed for tablet-generated graphics to meet printing standards. Additionally, the study discussed popular tablet apps, such as Procreate, Adobe Photoshop Sketch, Sketchbook, and Adobe Illustrator Draw. The findings provided insight into the strengths and limitations of tablet-based platforms, highlighting areas for improvement, and informing decision-making

for graphic designers and students in selecting appropriate tools for their projects.



Conclusion

In recent years, the adoption of tablet-based raster and vector graphic design apps in classrooms has been on the rise. Our findings shed light on the strengths and limitations of these tablet platforms in generating print-ready graphics for traditional printing processes, as well as highlighting areas for enhancement. According to Adoption Theory [22], younger adopters are more inclined to embrace new technologies if they perceive them as useful, user-friendly, and compatible with their current practices and values [12]. The integration of AI tools, design, and prepress output is likely, if not inevitable. The question of whether tablet-based platforms can serve as viable alternatives to traditional laptops and graphic design applications for graphic designers and students depends on the suitability of the tools for specific projects. Statista reports that global tablet shipments have declined from 230 million units in 2014 to 144 million units in 2020, while laptop shipments have risen from 160 million units in 2014 to 218 million units in 2020 [25]. This data suggests that laptops may be more popular than tablets for computing tasks. However, tablets maintain a substantial market presence in sectors such as education, healthcare, and retail, where their portability and ease of use are appreciated [10]. Thus, it remains uncertain whether tablets will surpass laptops and desktops in the future, as this outcome depends on various factors and market trends.



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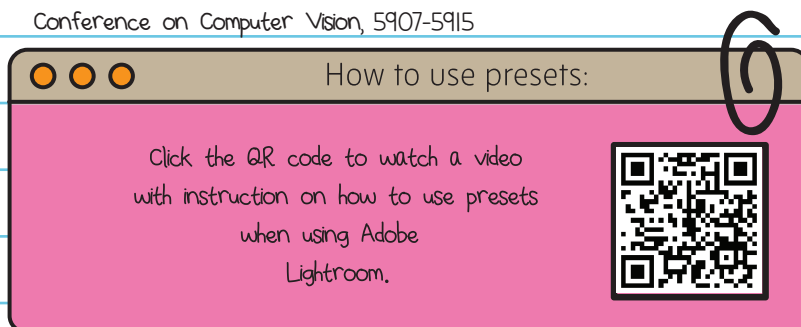
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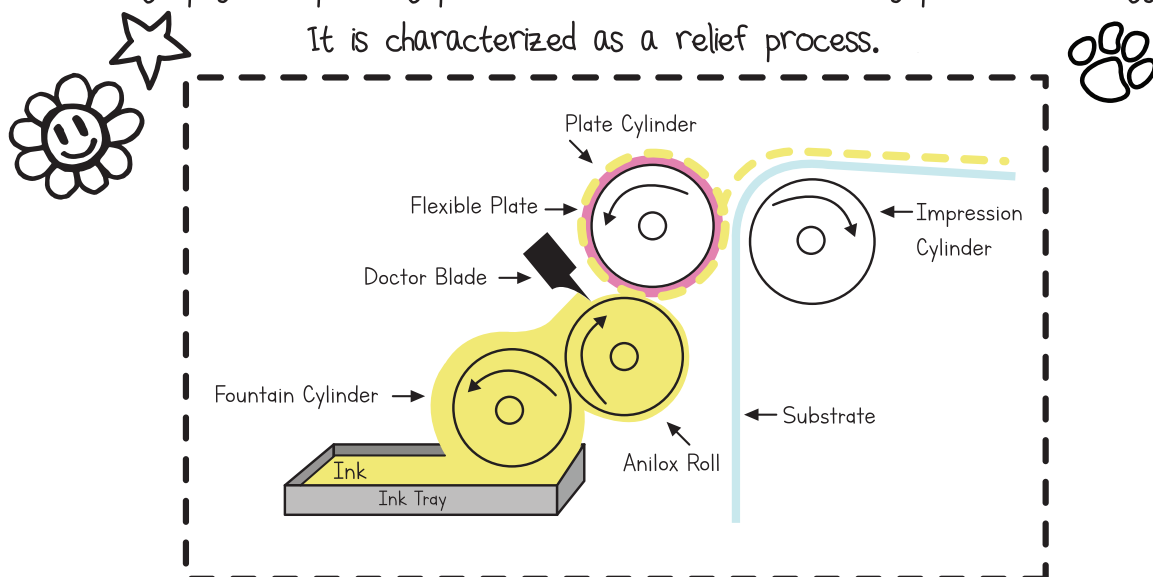
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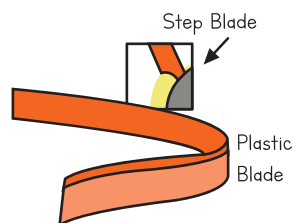
WHAT IS

Flexography is a printing process that uses direct rotary print technology. It is characterized as a relief process.



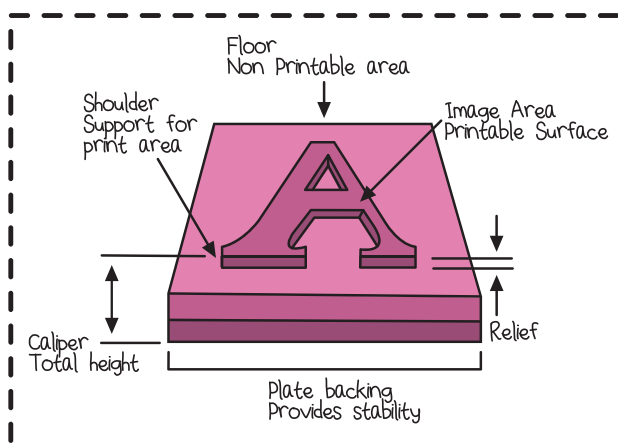
Doctor Blade

A metering doctor blade, like the one shown, removes excess ink from the smooth, non-engraved parts of the anilox roll.

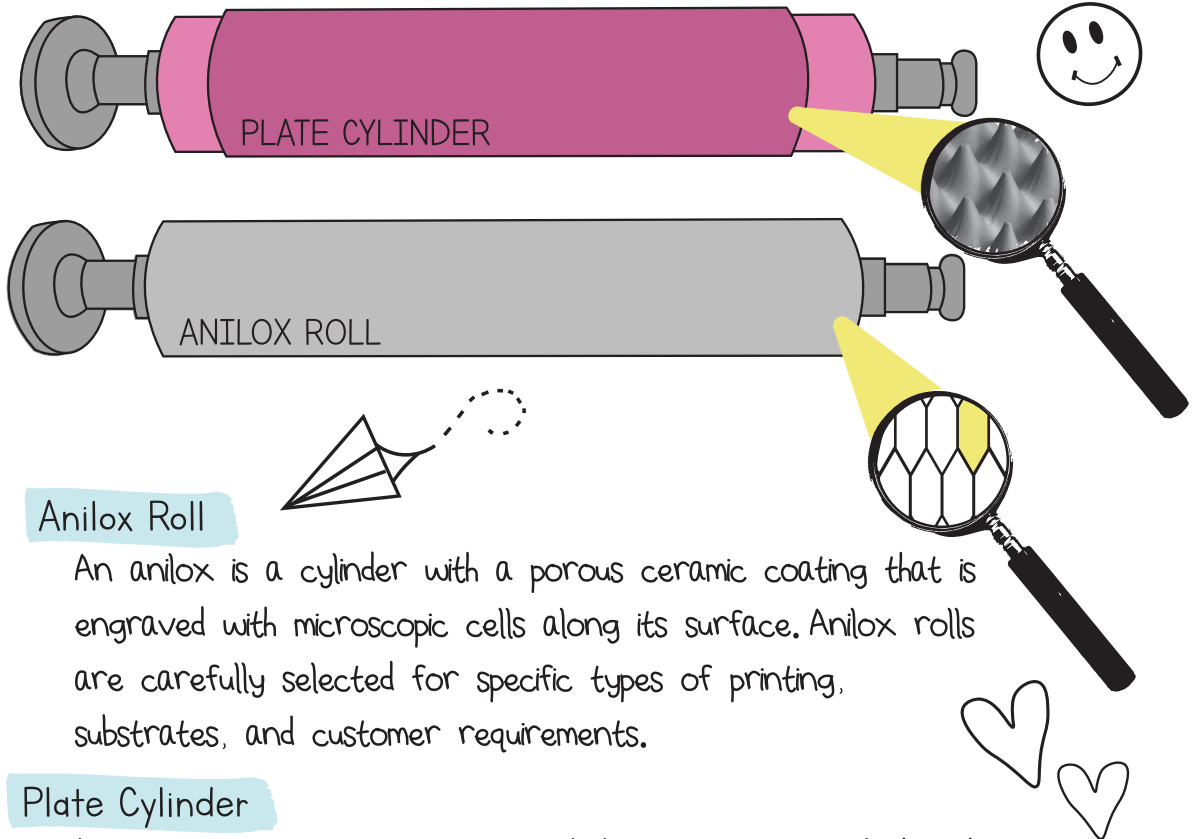


Flexographic Plate

Flexographic printing plates are flexible photopolymer plates, used in flexo printing to transfer ink & images to a flexible substrate, such as paper or film.



FLEXOGRAPHY



Anilox Roll

An anilox is a cylinder with a porous ceramic coating that is engraved with microscopic cells along its surface. Anilox rolls are carefully selected for specific types of printing, substrates, and customer requirements.

Plate Cylinder

The part of a printing press to which a plate is attached and which transfers the inked image directly to the substrate itself.

ADVANTAGES

- Variety of printable substrates.
- Variety of inks used:
 - Water-based, Solvent, and UV Ink.
- In-line converting.
- Uses a simple inking system that requires less rollers and is easier to maintain.
- Variable repeats obtained by changing the plate cylinder.
- Short and long run capability.
- Reusable plates.

DISADVANTAGES

- Over impression.
- Press registration tolerance.
- Press variables.





Meet:
DR. ERICA WALKER

Dr. Erica Walker has a diverse background in visual communications which includes feature film production, web design & development, print buying, marketing, and graphic design. As a faculty member in the Department of Graphic Communications at Clemson University, Dr. Walker has taught courses in Photography, Video, Visual Storytelling, Web Design and Development, and Entrepreneurship. Prior to becoming a faculty member at Clemson University, Dr. Walker co-founded a film production company, Galatia Films. Two of her larger projects with Galatia Films, as a producer and cinematographer, included a feature length documentary film and an educational television series for children. Outside the classroom, Dr. Walker speaks at conferences across the country on topics including classroom and industry implementation of Adobe applications, curriculum development, mixed methods classroom research, the entrepreneurial mindset, game-based learning, color management, branding, and social marketing. Her current research focuses on the use of AI and machine learning to ensure the consistency of brand colors in live video, Dye Sub and Inkjet printing of fine arts photography on non-paper substrates, and classroom research where she works as an instructional designer in partnership with industry expert adjunct (IEAs) lecturers.

Visit <https://www.youtube.com/@ClemsonGraphicCommTAGA/videos> to watch an interview with Dr. Walker with more information on her research "On the gameday sideline: A case study of web-based AI color correction for social media content."

ON THE GAMEDAY SIDELINE: A CASE STUDY OF WEB-BASED AI COLOR CORRECTION FOR SOCIAL MEDIA CONTENT

Dr. Erica B. Walker, Clemson University; Dr. D. Hudson Smith, Clemson University; Forrest Zach,
Clemson University.

Keywords: Artificial Intelligence, color management, brand, social media.



Abstract

Both sports brands and their fans value brand color accuracy across all mediums from jumbotron footage at a live event to social media content. ColorNet, a trio of color correction tools developed at Clemson University, addressed this concern. ColorNet 1.0 used a patented algorithm trained with paired datasets, ColorNet 2.0 addressed some weaknesses in ColorNet 1.0 and achieved similar results using machine learning segmentation, and ColorNet 3.0 was a combined hardware and software solution that allowed content creators to identify distortions in the color spectrum and apply appropriate targeted adjustments. This case study implemented ColorNet 1.5 as a web application intended for sideline, game day use by content creators to ensure brand color accuracy for social media content. Results show that content creators who participated in this study highly value and can identify brand color correctness and that increased processing speed would be a necessity for production-level implementation of this tool.

Introduction

Achieving consistent brand color is challenging in a fast-paced sports game day environment. When consumers look at branded content across many different devices and channels, they expect to see their favorite team with accurate brand color representation (eg. Budelmann et al, 2010; Chang & Lin, 2010). However, there are challenges at a live event. Content creators work in small teams on the sideline during the day trying to capture, edit, and post the most memorable moments through both photographs and video clips to multiple social media channels in as close to real time as possible. In the higher education environment, the social media content team often includes student interns with limited professional experience and content is created across several camera models from multiple manufacturers. For example, when this study began, a standard kit for Clemson Athletics included: Five different camera bodies: Sony A7III, Sony A7SII, Sony A7SIIL, Canon 5D Mark IV, and Sony FX3 and three Sony lenses—24-70 mm, 70-200 mm, and 100-400 mm—and two Canon lenses—24-70 mm and 100-200 mm. Each iteration of these cameras and lenses produces different color representation in the resulting content (Golabkesh & Walker, E.B., 2022).

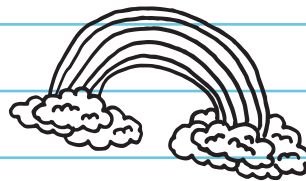


Previous studies conducted at Clemson University revealed that approximately half of the fans participating in the study recognized when brand colors are off specification on the jumbotron, and even more commented on the inaccuracies when they were asked specifically about the color representation (Conti & Walker, E.B., 2019). ColorNet is a patented artificial intelligence algorithm that is capable of addressing this issue by detecting and correcting a specified brand color pixel-by-pixel in a live video feed (eg. Walker, E.B.,

Smith, D.H., Lineberger, J.P., Mayer, M., Mayes, E., & Sanborne, A., 2020; Walker, E.B., Smith, D.H., Mayes, E., Lineberger, J.P., Mayer, M., & Sanborne, A., 2020).

A more recent study applied the ColorNet algorithm in a social media context to see if it could also improve color consistency on real-world social media content across channels, platforms, and content types. The study found a statistically relevant improvement in brand color representation after processing content from this context (Smith, D.H. & Walker, E.B., 2022). Analysis included both brand color and skin tones from content that had been posted on Twitter and Instagram across nineteen official accounts over the past ten years.

This study builds upon previous work to develop and implement a web-based ColorNet application that could be used in a real world, game day situation with Clemson Athletics content creators as a case study.



ColorNet: Version History

ColorNet has three current iterations, each developed to address brand color correctness on imagery in a unique way. Version 1.0 was based on a data-trained algorithm with the initial goal of ensuring brand color consistency for video displayed on a jumbotron at live sporting events. ColorNet 1.0 created an anticipated mask and applied it to the original, color-incorrect image in order to output a color-correct image,

Figure 1. The advantage of ColorNet 1.0 was that it was a light, quick-running code base that

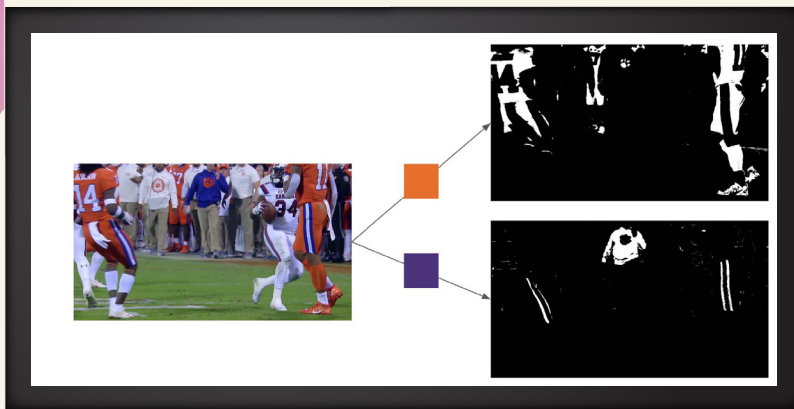
proved effective in live alpha and beta tests running at 60 frames per second (fps) at 720p. The major weakness of this version was that each new color a user wants to target for correction requires a new, manually created dataset and time to retrain the algorithm and test the results.



In order to address the necessity of manually creating datasets for each additional color, ColorNet 2.0 used a convolutional neural network to output segmentation masks, Figure 2. Segmentation is typically used to identify objects but in our case we wanted it to identify specified parts of the color range. This version selected pixels near a specified color in the spectrum and masked them for correction, ignoring all pixels not identified as the target color. This model worked with color in the HSL (hue, saturation, and lightness) color space rather than in RGB (red, green, and blue) which helps target a brand color whether it was found in highlight or in shadow. The advantage of ColorNet 2.0 was that no training data was needed and adding new target colors was quick. Disadvantages included a slower model and an increase in target artifacts resulting in less "clean" corrections.



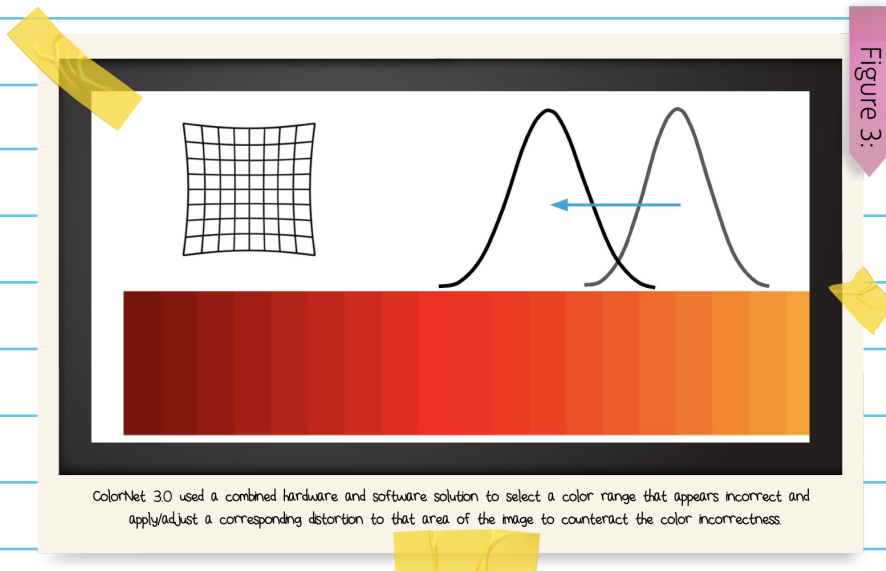
Figure 2:



ColorNet 2.0 used segmentation to select a portion of the color spectrum in each frame, eliminating the need for manually created datasets.

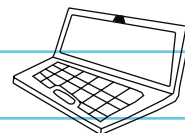
ColorNet 3.0 was a non-machine learning approach that focused on identifying the "distortions" present in the color rendering seen on screen, Figure 3. This combined hardware/software solution applied a targeted, adjustable distortion to incorrectly colored images to reveal the "true" brand colors. The strengths of ColorNet 3.0 was that it was computationally efficient, it does not require any training data to target additional colors, and multiple colors can be selected and the distortion adjusted individually by the production team for each event using the provided hardware device. The disadvantage was that the production team needs to manually determine the target colors and level of anticipated distortion which may require initial training. The development team plans to provide a set of preprogrammed, commonly used settings to reduce this impact.





Experimental Procedure

This study consisted of three parts: a pre-survey, a baseline implementation, and a post-survey. Participants were recruited through contacts with the athletics and university-level content creation teams.



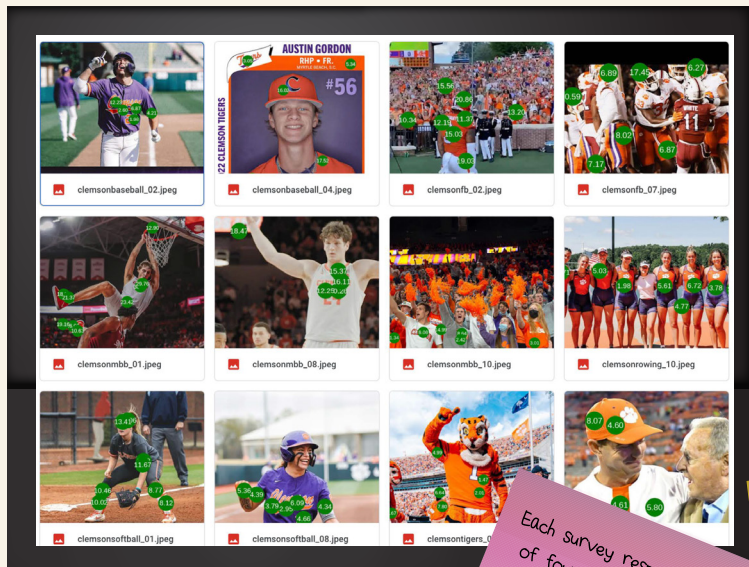
Pre-survey

The pre-survey investigated the level of tolerance for brand color accuracy to understand a baseline of visual preferences at the creator level. This survey also determined the need to continue pursuing this development based on whether the content creators recognized and desired to fix brand color inaccuracies. Section one of the survey covered basic demographics and asked if the respondents had been previously

tested and/or diagnosed with any visual color deficiencies. In the second part of the survey, each participant received seven of fourteen randomized photos pulled from social media and were asked the following question: "How close is this to being ready to post?", Figure 4. Finally, we asked if brand color accuracy was important in their personal and team workflow.



Figure 4:

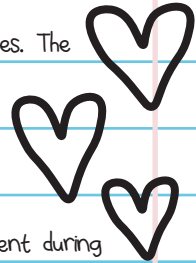


Each survey respondent received seven of fourteen randomized images pulled from previous social media posts across seven official channels and asked "How close is this to being ready to post?" The green circles indicate the measured ΔE value relative to the Clemson brand orange used in the quantitative post-survey analysis and were not shown in the survey.



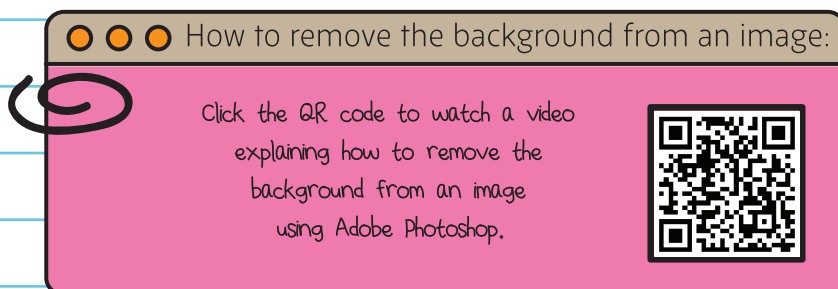
Case study

The case study examined a five day-period where users implemented the web application. The web application design stack was React-Flask-Python. PyTorch was used to train the machine learning (ML) model used to correct the uploaded images. The application was hosted on an IBM Cloud compute instance.



Each participant confirmed that they were attending an athletic event during the specified time period where they would collect and upload photographs capturing brand color content in the scenes. A PDF detailing the instructions on how to use the web application was provided via email, Figure 5. The developer was also available through email to address any questions or issues that arose during the specified dates.

Each photograph was uploaded by the participant to our servers, automatically labeled based on a provided user name, processed through ColorNet 1.5, and then available for download to the content creator. After the case study, the research team had access to both the original, uploaded photograph and the resulting processed image. From these matched pairs, we were able to make Delta E-based, pixel-level comparisons to each users' images to confirm the efficacy of the color correction.



1. <http://52.118.210.35/>
2. Set camera capture to jpg
3. Select "Choose Files" and select images for uploading
4. Enter your Clemson username in the "Username" text field
5. Press "Process."
6. Once the ColorNet Logo disappears, your images are being processed. Do not press "Process" again.
7. Once loaded, use the slider to compare before and after. Before is on the left, after on the right.
8. Use the arrows located at the bottom of the screen to toggle images
9. To download: scroll to the bottom of the page, click "Download Images."

Welcome to ColorNet!



ColorNet

#3 → Choose Files | 2 files Username: clemson ← #4

#5 → Process



#8



#9 → Download Images

Each participant in the case study was provided with a set of visual and written instructions via email

Figure 5:

Post-survey

Feedback regarding the experience using the web app was provided via a post-survey and by examining the paired original and post-ColorNet-corrected photographs uploaded by users. The post-survey asked users about their specific camera and workflow on the day they uploaded images to ColorNet followed by a set of four questions focused on the user experience of the application.



Mixed methods analysis used qualitative and quantitative individual feedback from content creators before and after using the app in their process as well as analysis of the brand color consistency across the resulting pre/post image pairs to measure the

resulting ColorNet adjustments. The image pairs were analyzed based on pixels identified as brand color content in "neutral" lighting in each of the fourteen images in the survey were identified using LabelBox, an online tool for image analysis. Any areas of the image that displayed brand color is extreme highlight or shadow or looked noticeably faded (i.e. seatbacks in the stadium that sit in full sun year around) were not identified or factored in to avoid skewing the data.

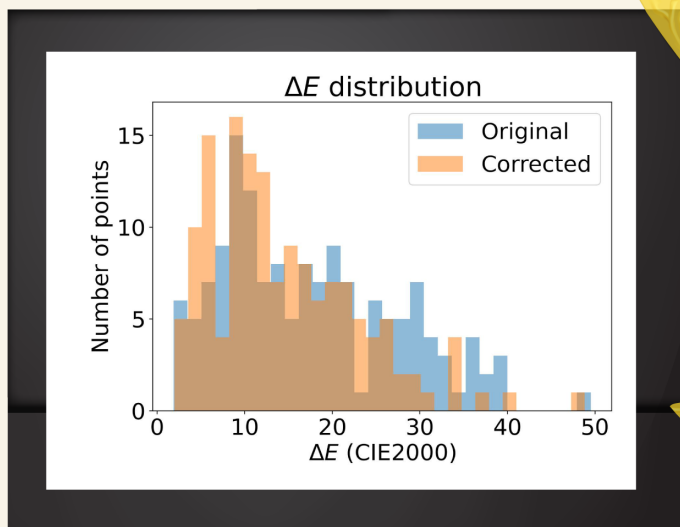
Results and Discussion

Pre-survey

Fifteen participants responded to the pre-survey with an age range of 20-48 and a mean age of 26.5 years old. Professional experience in athletic content creation ranged from six months to over ten years, with a mean of 4.6 years of experience in an equivalent industry. Of the respondents, nine identified as male and six as female. Seven were students including representatives across four different majors. Eight out of fifteen had previously taken a color vision test and of those eight, none had received a diagnosed color deficiency.

Images were analyzed based on pixels that were identified as Clemson brand orange using the online tool LabelBox. Each image had between four and twelve pixels that were identified as brand color in neutral lighting. The RGB values of each pixel were compared to the brand specification provided by Clemson University using the Delta

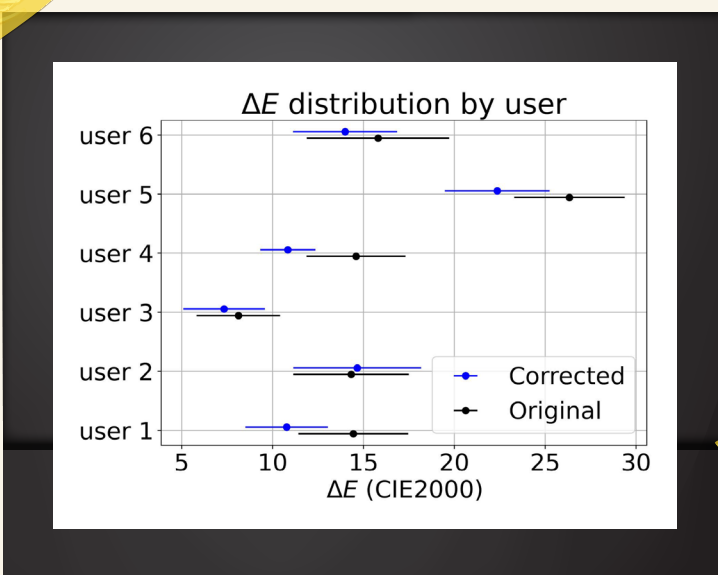
Figure 6:



Visualization of overall ΔE distribution individual data points from across all photographs.



Figure 7:



Visualization of ΔE distribution for each user, showing the range of values and the average (dot in center) for both original and corrected images.

E 2000 formula and an overall "grade" was determined for how far off the image was from appropriate brand color. This grade was then aligned with user responses regarding how close an image was to ready to be posted in regards to color accuracy. For example an overall high Delta E (ΔE) value across all the specified pixels indicated an image that should require additional color correction before being ready to post on the official social media channels.



Hypothesis 1:

Images with higher ΔE values would lead to users responding that higher levels of color-based correction were needed. Findings indicated that there is a significant positive relationship between the likelihood of saying an image needs major correction and worsening color accuracy in the images. The conclusion we draw is that this audience is sensitive to major color errors, at least in this brand color. In fact! holding all things equal, if our audience sees a ΔE of 10, they are 4.86x more likely to say it needs major correction than an image with a 4.35 ΔE .

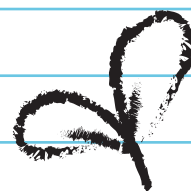
Hypothesis 2:

Individuals who said that color accuracy is "very important" would respond that higher levels of correction were needed when compared with respondents who say "somewhat important." All of this audience thought it was somewhat or very important. Therefore, there was not a significant difference between those two responses and how much they felt an image needed adjusting.

Case study

Six participants engaged in usability testing of the web application. They uploaded a variety of different images from a range of different events and environments. There were four participants who identified as male and two as female with an age range of 20-34 and a mean age of 25.5 years old. Professional experience in athletic content creation ranged from six months to over ten years with a mean of 4.6 years of experience. Job titles include various content creation and directorial roles such as "Content Creator" and "Associate Director of Creative Solutions."

The participants used the web application in different environments: three used the application at a live event, one during an athletic practice, and one from an office setting. Four participants captured their images with both a mirrorless camera and their smartphone and one participant exclusively used a smartphone for image capture. Additionally, participants utilized the web application at different points in their workflow with three using the application after the images were processed through an Adobe Lightroom profile and two using only the provided application for image processing. Two participants even went on to post the images processed by the web application to social media. Three participants had questions while testing the application and received direct assistance from the developer.



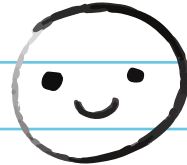
The web application's usability testing revealed some issues with the color correction algorithm. Images that had four instead of three color channels would break the algorithm (eg. RGBA images) and images that were very large (4k+ pixels) were also problematic. Once we were aware of these use cases, these issues were addressed by the second day of testing, allowing for all of the remaining participant's images to be processed. One major flaw of the web application was that all the color correction was processed on the web server itself, meaning that the images had to be uploaded, processed, and then downloaded back onto the participant's device. While this process was entirely automatic, there was a significant amount of latency introduced when many images were uploaded simultaneously or when the participant had poor internet connection speed.



We measured the color accuracy of the uploaded images before and after color correction to understand the impact of ColorNet on Clemson's brand color consistency. Locations that should represent brand orange (jerseys, helmets, etc.) were manually selected for each image, again using LabelBox to identify and output specific pixel values. Using the RGB values at these locations, the ΔE value was measured relative to Clemson brand orange (Pantone 165). The effect of ColorNet on brand color accuracy was then evaluated by comparing the ΔE values before and after color correction. User 5 uploaded 34 photos, which was skewing the ΔE analysis so instead 3 photos were selected from that user to have a more consistent data set across participants.

ColorNet shifted the distribution of ΔE values toward zero, implying an overall improvement in color accuracy, Figure 6. However, this shift was not experienced

equally by all users with some receiving no significant benefit (eg. user 2), and others experiencing large benefits (eg. user 4), Figure 7. We speculate that this resulted from differences in camera equipment, base camera settings (eg. JPG vs RAW and in-camera picture profiles), and post-processing methods used across participants.



Post-survey

Five users filled out the post-survey after using the web application during the case study. When asked how accurate the users felt ColorNet was for correcting brand color, three responded that it was somewhat accurate and two responded that it was very accurate. When considering how fast using the ColorNet app was, the result was a bimodal distribution. This was likely due to challenges with the internet connection during live sporting events or when a user submitted a high number of photographs simultaneously and the retrieval of the corrected images after processing was noticeably slow.

Users found the app to be reasonably intuitive. We can start to see a possible normal distribution with this question with one user responding that it was not very usable and four responding that it was either moderately or very usable. The final question asked if users would consider employing the ColorNet application in their workflow again. To this question, one respondent said not very likely and one said very likely, with the other three saying they would be somewhat likely.

This analysis is limited by the relatively small number of participating users. Across all of these questions, more user input following another round of development would be necessary to have a better feel for the usability, speed, accuracy, and projected likelihood of using the app in the future.



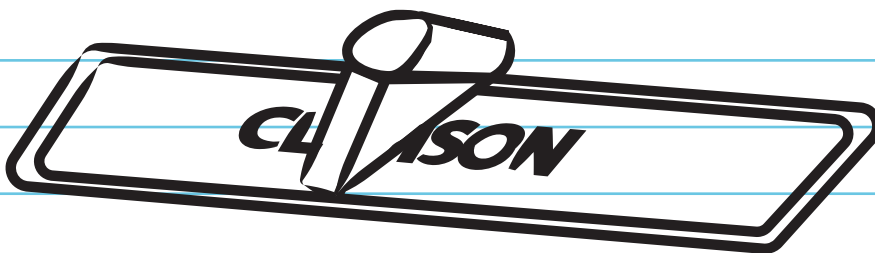
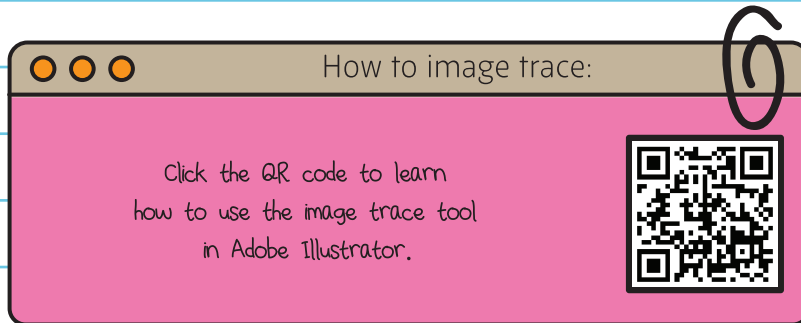
Conclusion

In conclusion, implementing an in-development web application in the field presented challenges but it also led to valuable information to guide future efforts in further development and improvements to processing speed. Although the color correction provided by ColorNet 1.5 was accurate enough in practice, the primary bottleneck in the system was the time cost of uploading and downloading the images over the internet. This is especially true in the fast-paced environment common to our target participants. A mobile application, versus a web application, would provide benefits in this area by moving the image processing from an external server to the user's device. This change would allow for much faster processing times and not be limited by unreliable internet connections. Additionally, the current ColorNet implementation could offer improved processing speeds by adding more computing horsepower to the host server. When considering usability, we would like to improve the clarity of what is happening on the app during wait times (eg. when images are uploaded and downloaded). In addition, users requested that we include the option to fully toggle between uncorrected and corrected final images within the app, providing a more clear visual of the pre- and post-corrected image.

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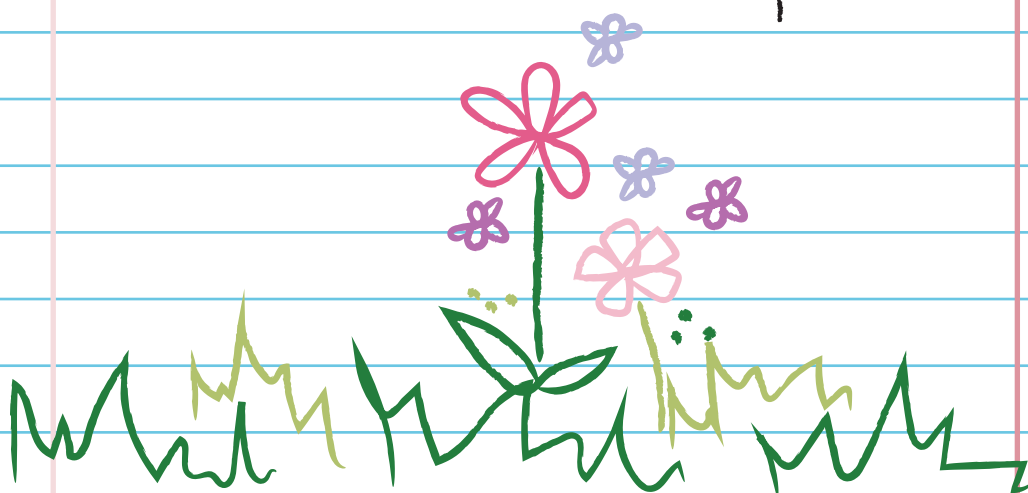
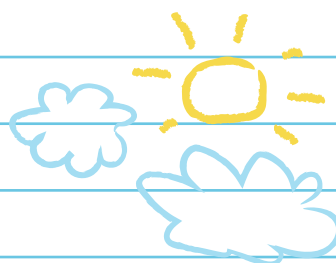
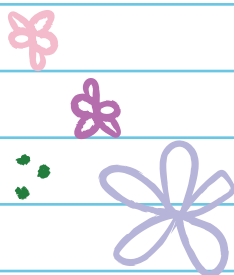
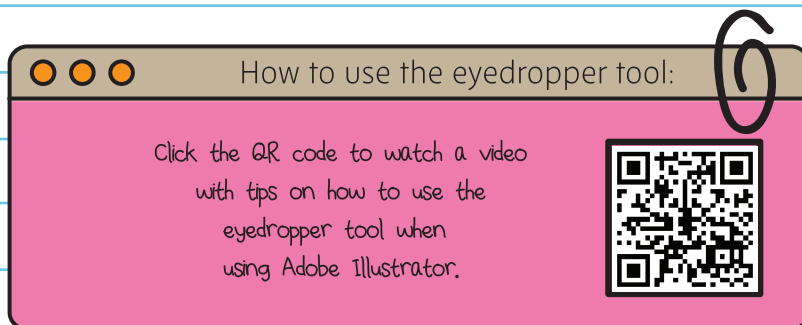
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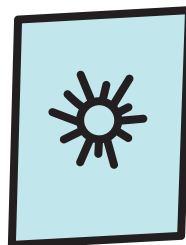
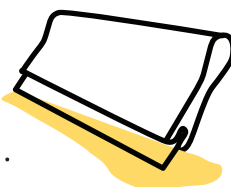


HOW TO!



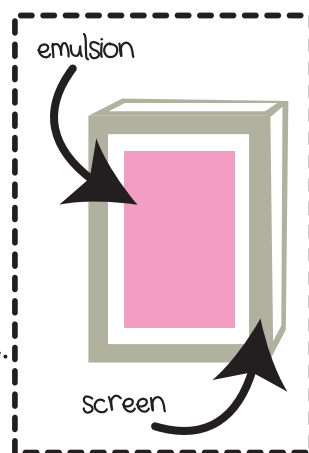
Degrease:

- Spray both sides of the screens with water.
- Spray degreaser on both sides of the screen.
- Scrub both sides and let it sit for a bit.
- Rinse both sides of with the pressure washer.



Scoop Coat:

- Put emulsion into scoop coater.
- Lean screen back at a 45 degree angle and put scoop coater to screen and wait until emulsion touches it.
- Pull scoop coater up along with the screen.
- Repeat this on the squeegee side.
- Back to print side, flip 180 degrees repeat.



Exposure:

- Place the screen print side down into the exposure unit.
- Put the rope on top of the screen, not touching the image.

Washout:

- Spray both sides of screen with water, let it sit for a second.
- Spray the screen with the pressure washer until the image is shown.

Blockout:

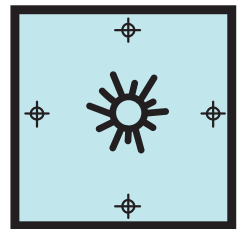
- Pour a line of blockout in between the metal frame and the emulsion on the print side.
- Use a squeegee to spread and reapply as needed.
- Using the hard squeegee get off the excess blockout on the squeegee side.
- No blockout in image area.



SCREEN PRINT

Registration:

- Place film onto the palette.
- Secure the screen, print side down, as close to the registration marks as possible.
- Use the minute adjustments to line it up perfectly.
- Tighten the screen to keep it in place.



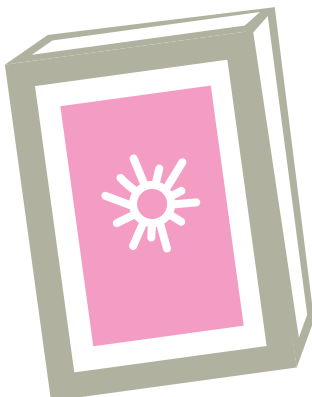
Print:

- Place substrate onto the palette and put the screen back down.
- Put ink at the top of the screen.
- Using the squeegee, pull the ink over the image a couple of times to make sure everything was covered.
- Place the finished product into belt dryer.



Clean:

- Get all the excess ink off.
- Put excess ink back into the ink jar.
- Clean the squeegee with the Plastisol spray.
- Take the used screens to the reclaiming area.





Meet:
DR. AMANDA BRIDGES



Dr. Amanda Bridges is a graduate of Appalachian State University's Graphic Arts and Imaging Technologies program. It was at App State when she discovered her love for teaching. After leaving App State, she decided to further her education at Gardner Webb University and continued to follow her passion for teaching.

Dr. Bridges enjoys being apart of the Clemson.GC. program where students have the opportunity to design something and see it all the way through production. This is something that she yearned to provide to her former students and is pleased to have a large amount of production equipment to help bring a design to life. Dr. Bridges has a strong passion for both design and prodution and extends this through her courses. One important piece of advice that Bridges would tell students is to always keep learning , even after leaving the program. Being in an ever-changing industry that is so influenced by technology, she advises that continual learning helps to make students adaptable and ready for change after graduation.



Visit <https://www.youtube.com/@ClemsonGraphicCommTAGA/videos> to watch an interview with Dr. Bridges with more information on her research "Dye Sublimation: An Image Quality Comparison between Pre-coated and Self-coated Non-traditional Substrates."

DYE SUBLIMATION: AN IMAGE QUALITY COMPARISON BETWEEN PRE-COATED AND SELF- COATED NON-TRADITIONAL SUBSTRATES

Dr. Amanda Bridges & Dr. Erica B. Walker

Keywords: Dye sublimation, Sublimation coatings, Non-traditional
substrates, Image transfer and color gamut.



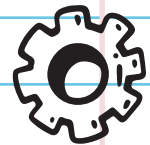
Abstract

This study examined pre-coated substrates as well as three additional selfcoating products to determine which substrate and coating combination provided the best image transfer across different types of photography using the dye sublimation printing process. The substrates included in this study were wood, glass, metal, and tile. Different sublimation coatings were used for each self-coated substrate. Some coatings increased challenges with burning, paper sticking, and inconsistent ink transfer. A color target was printed on all substrates and a spectrophotometer was used to record LAB and density readings. Once all color readings were gathered, a comparison of each substrate across coatings was made. For example, we compared wood to wood, tile to tile, and so on between the different coatings and the pre-coated blanks. Based on a combination of visual observation and Delta E calculations, we found that each coating performed differently based on the substrate being tested. In general, precoated along with

Coatings B and D performed the best overall.

Introduction

Moving into digital replication of photographs, two processes are commonly used for photographic reproduction: dye sublimation and inkjet. Dye sublimation was introduced in the mid-1980s and is commonly used today for printing on polymer or polymer-coated substrates (Ohno, 1996). Dye sublimation, also referred to as heat transfer printing, is frequently used to transfer designs onto plastics, polymers, and textiles and has also been used to print on metal packaging (Turner, 1998). The process involves drafting the design, printing it onto transfer paper using special sublimation inks, preparing the substrate for printing, and applying the heat press to the substrate with the affixed transfer paper. Once the sublimation occurs (solid ink becomes gas), the material becomes permeated with the gas, the paper carrier is removed, and the image adheres to the substrate (Digital Technology Group, nd). The penetration of the ink into the polymer substrate or coating provides a scratch and environmentally resistant final photograph. Mass produced spray and liquid-based polymer coatings allow for printing on a wide range of flat substrates and multidimensional surfaces such as hats and glassware (Xu, 2017).



In order for ink to adhere during the transfer process, the substrate must contain polyester or a polymer coating. These non-paper substrates, often referred to as sublimation blanks, can be purchased pre-coated or coating can be applied manually to any uncoated, non-plastic substrate. There are many pre-coated

* Clemson University

substrates available however, for more non-traditional surfaces such as wood or stone tile, self-coating may be required. Sublimation coatings are available in both liquid and aerosol forms with liquid being most common for hard, inflexible substrates. When dye sublimation is used on alternative substrates color accuracy becomes a factor because there is no longer a "paper white" base for the image and without an application of a white base coat, the color and texture of the substrate itself becomes a part of the resulting photograph.



Some advantages of dye sublimation printing are full color with a single pass unlike traditional screen printing, flexography, and lithography, high quality prints, print durability, versatility, and ease of replication and use (Apo, 2020). Printing of a 300ppi source image actually results in an effective ppi of 2400 due to the transformation of the ink into gas during the heat press process (Makenji, 2011).

Building on a previous study examining the durability of color when exposed to environmental conditions such as humidity and UV fullspectrum light (Walker & Bridges, in review), this study will focus on different brands of liquid coatings and examine application processes to ensure even coverage across substrates. By examining both pre-coated substrates as well as three additional self-coated products, we will determine which substrate and coating provides the best image transfer across different substrates.

Methods and Procedures

The purpose of this project is to determine which dye sublimation self-coating provides the best image quality across four different substrates: glass, metal, tile, and wood. Four different self-coatings were tested as well as pre-coated blanks.

Pre-coated substrates, in general, provide more consistent results however users are limited in terms of size and type of substrate. This study sought to answer the following research questions:

- 1) Of the four self-coatings, which one provides the best overall image transfer for glass, metal, tile, and wood.
- 2) Which coating, including precoated substrates, provides the best color representation for different types of photography: landscape, portraits, and black and white? and
- 3) Based on this study, what are the recommended coatings and dye sublimation settings for each substrate and type of image?

There are a wide range of coatings on the market including both liquid and aerosol options. Four coatings (3 liquid, one spray application) were selected for the project. Ingredients for two of the liquid coatings were identical and were comprised of acrylic, pigment yellow, glycerol, copper phthalo cyanine, and deionized water.

Ingredients for the other two coatings were not provided. A different sublimation coating was used for each self-coated substrate. Uncoated substrates were purchased from Lowes Hardware or found as scraps and the pre-coated blanks were purchased



from a dye sublimation retailer.

To begin, two coats of polymer coating were applied to the samples using a sponge brush applicator, the second coat was applied one hour after the first to allow for dry time. The spray coating was applied using a spray bottle then evened out with the same type of applicator. The substrates then dried for no less than 24 hrs prior to curing. The sublimation blanks were then heat cured according to manufacturer guidelines (16x20 Geo Knight heat press).

A color target was then prepared in Adobe Illustrator and printed on Epson Dye Sublimation Transfer Multi Use Paper using an Epson SureColor F570 printer. The color target included 72 patches to represent a wide range of tints, hues, and skin tones often produced in photographic imagery. Thirty-one patches were representative of tones commonly found in landscape photography, twenty-two patches were of skin tones, and nineteen covered levels throughout the grayscale printed with black only and the equivalent cyan, magenta, and yellow builds. Transfer paper was then placed on each sublimation blank (self-coated and pre-coated) and pressed, Table 1. Once the cured samples were cooled, the target was attached and placed in the heat press to print, Table 2.

	TIME	PRESSURE	LINER	TEMPERATURE
GLASS	5 Min 10 Sec	≈50	0	Parchment Paper
METAL	1 Minute	≈60	2	Parchment Paper
TILE	5 Minutes	≈50	0	Parchment Paper
WOOD	2 Minutes	400	1	Parchment Paper

Table 1: Dye Sublimation Settings for Curing.

GLASS	5 Min 10 Sec	≈50	0	Parchment Paper
METAL	1 Minute	≈60	2	Parchment Paper
TILE	5 Minutes	≈50	0	Parchment Paper
WOOD	2 Minutes	400	1	Parchment Paper

Table 2: Dye Sublimation Settings for Printing.

Results and Discussion

We measured each color patch using an X-Rite Spectrophotometer set to M1 daylight to record density and CIElab values. Then using the DE76 formula, we determined the difference between the initial color values in the target and the printed patch. This resulted in individual patch DE values, an “all target” DE average value, and an average for each of our sets of patches: landscape (n=31), skin tones (n=22), and neutrals (n=19), Table 3.

COATING	SUBSTRATE	AVERAGE DE	LANDSCAPES (1-7, 10-16, 19-25)	SKIN (8-9, 12-18, 27-34)	NEUTRALS (36, 55-72)
A	G	43.76	56.46	41.65	26.55
B	G	14.55	14.98	16.63	11.37
C	G	16.65	16.81	119.28	13.37
D	G	15.01	15.51	17.15	11.62
PC	G	46.19	52.80	44.82	36.50
A	M	40.08	45.34	36.22	35.21
B	M	29.12	28.82	27.93	31.20
C	M	30.14	29.80	30.10	30.76
D	M	29.54	30.80	28.88	28.05
PC	M	29.63	35.30	25.41	25.30
A	T	48.37	59.05	42.99	38.77
B	T	5.75	7.21	3.54	5.74
C	T	6.65	7.19	6.32	6.21
D	T	5.50	7.00	3.55	5.18
PC	T	7.82	9.97	6.45	5.88
A	W	30.67	38.20	19.92	30.06
B	W	32.74	38.11	24.98	32.01
C	W	35.38	39.67	27.44	36.66
D	W	26.54	28.58	19.13	31.20
PC	W	26.70	30.23	21.93	25.95

Table 3: Average DE values for each coating and substrate.

Glass



Glass had no absorbent qualities, which provided a challenge during application but all the coatings dried as expected. On glass, this resulted in minimal image transfer for Coating A and texturing across all the selfcoated samples, especially Coating C which showed major texturing beneath the print. There was sticking of the paper with both Coatings A and C during the heat transfer process. After printing, pre-coated had a matte finish, whereas all other substrates were shiny and maintained a reflective quality common for glass. Color measurements revealed that if printing landscapes, portraits, or black and white photos, Coating B is best on this substrate, Figure 1.

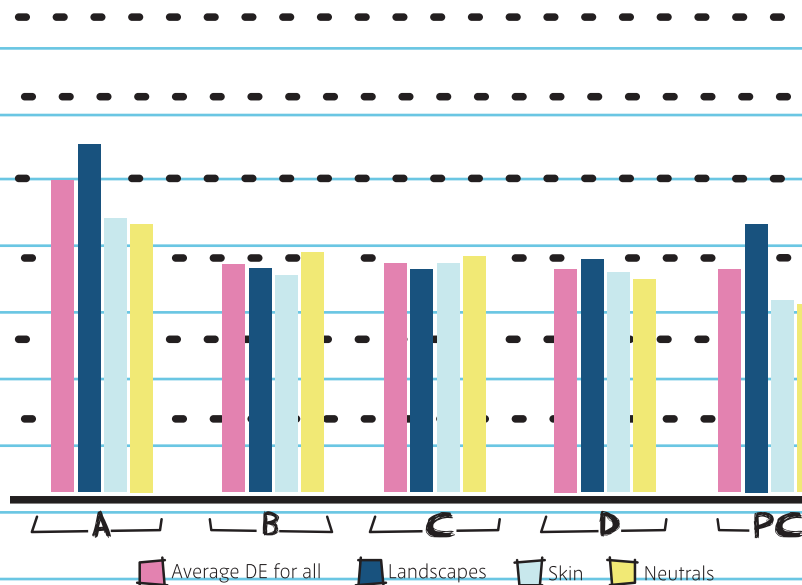


Figure 1: DE results for glass reveal that Coatings B, C, and D result in more accurate color transfer compared to Coating A or the pre-coated glass.

Metal

Similar to glass, metal does not have absorbent qualities. Coating A produced poor image transfer and Coating C resisted a smooth coat on this substrate. Based on visual observation after printing, self-coatings provide more sheen and vibrance but could produce an uneven texture due the coating application process when compared to the pre-coated substrate. The recommendations for metal are dependent on the type of photograph being reproduced. If printing portraits and black and white photos, pre-coated substrates are best overall, but if you prefer self-coated, Coating D is best for black and white photographs. For self-coated landscapes or portraits, Coating B is best, Figure 2.

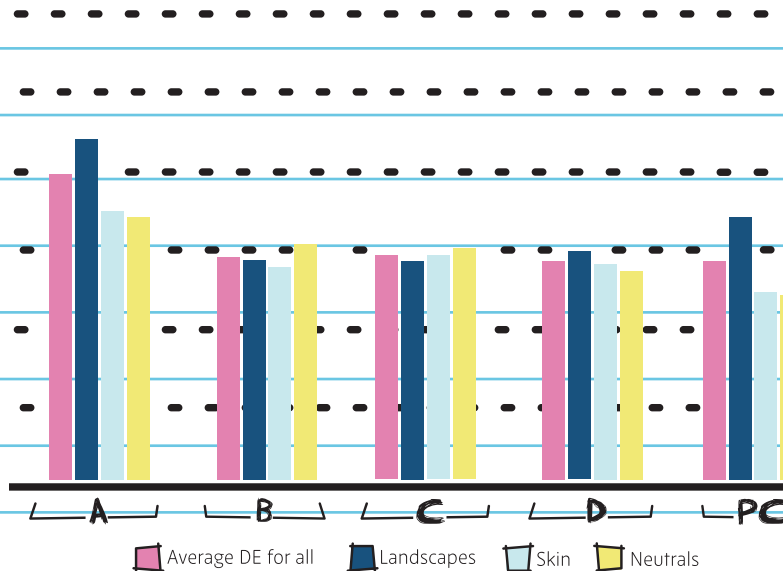
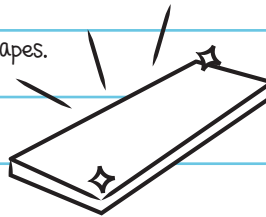


Figure 2: DE results for metal reveal that pre-coated substrates provide a color transfer advantage for portraits and black and white photographs whereas Coating B is best for landscapes.

Tile



Although tile is normally not absorbent due to the gloss coating, tile does have the advantage of being bright white and therefore best able to color match the original patches. Coatings B and D display minimal noticeable texture under the print and once again, Coating A had poor image transfer. The transfer paper had sticking issues with Coatings A and C. Overall self-coated with Coatings B, C, and D provided the best color transfer compared to pre-coated tile. If printing landscapes, portraits, or black and white photos, coatings B and D are best. Black and white photographs transfer similarly across pre-coated and Coatings B, C, and D, Figure 3. Note that these results change dramatically across different types and colors of tile.

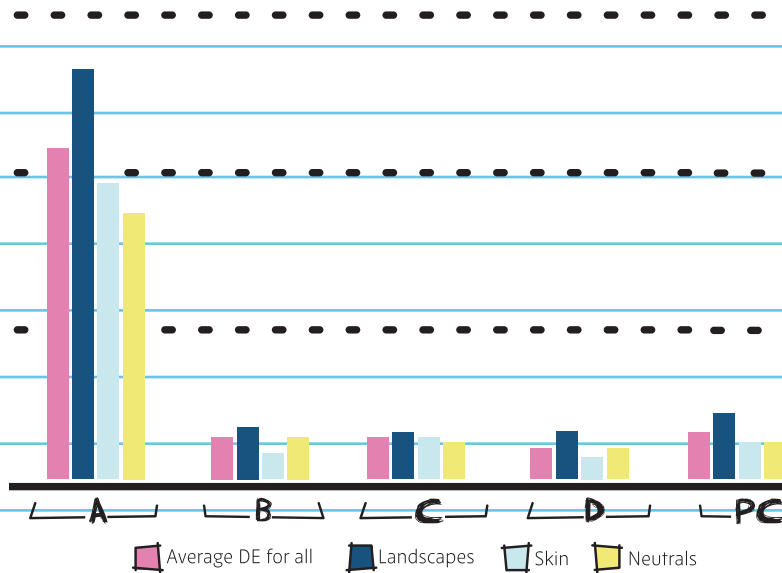


Figure 3: DE results show that self-coated white tile can very successfully match colors compared to the other substrates in this study, with the exception of Coating A.



Wood

Wood is the most absorbent of all the substrates used in this study but it also tends to darken and even crack during the heat press process due to the water content natively present in this material. This moisture might also have also been a factor in the transfer paper sticking, as was seen in Coatings B, C, and D with C showing significant sticking. The stuck paper was removed with water and gentle scrubbing which did not negatively impact the final image. When considering the reflectance after printing, Coating A and C had minimal sheen and B and D were quite shiny. Precoated had no shine on the resulting image. Coating A was somewhat



successful at transferring the image onto wood, most likely due to this coating being made for absorbent materials like cloth. If printing landscapes or portraits, Coating D is best for color accuracy but if printing black and white photos, pre-coated is best followed by Coating A, Figure 4.

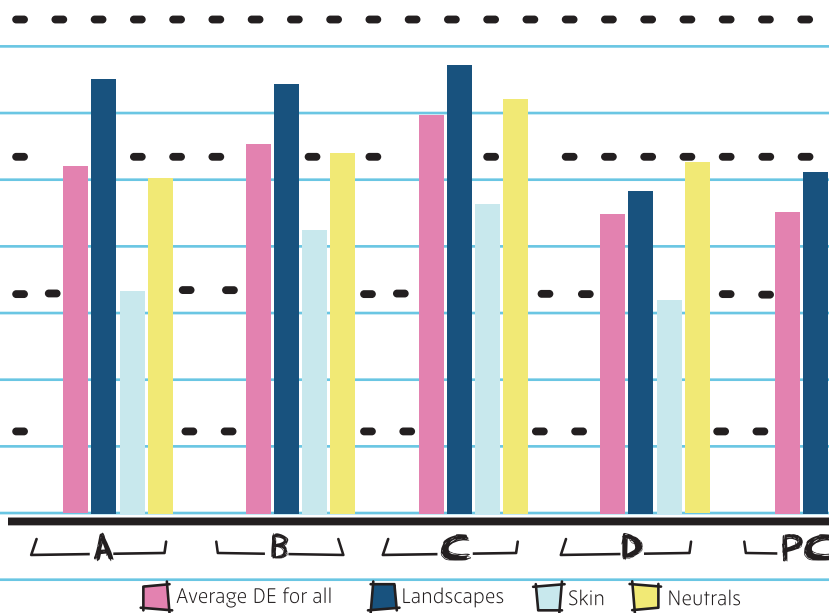
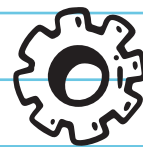


Figure 4: DE results show that wood significantly impacts color match, even on the pre-coated sample.



Conclusions

We anticipated Delta E values that would be unacceptable in traditional color-managed printing because the substrate was not traditional "paper white" and therefore contributes undertones to the resulting color in the print. In fact, the substrate itself became a contributing part of the artistic result adding both natural

texture and color to the resulting printed photograph. If the intent is to reduce that impact, it is recommended to add an undercoating of white beneath the printed image, a commonly employed process for professional prints on these substrates.



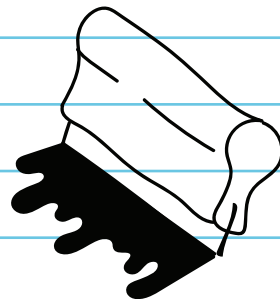
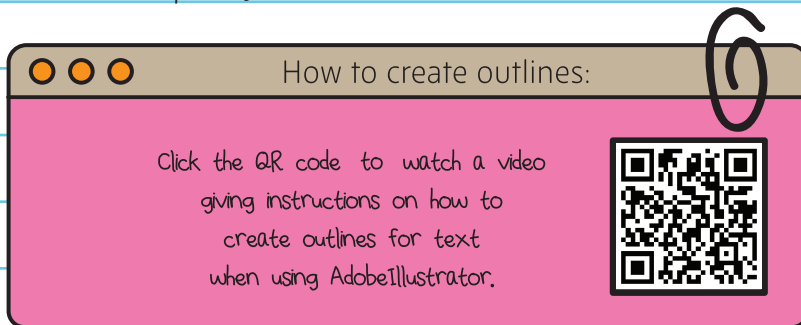
For this investigation, we wanted to maintain the impact of substrate on the resulting artistic piece. Therefore, we decided to use DE combined with visual observations to focus our investigation on which coating is preferable if an artist wants to print on a non-traditional substrate and capitalize on the substrate's natural characteristics. Using the resulting measurements, we compared across coatings and the pre-coated sample within a single substrate. Results show that if a photographer is focusing on only one type of substrate or subject, more specific recommendations (Table 3) can be made but if they prefer the flexibility to use self-coated across multiple substrates, we recommend Coatings B or D, which performed best, in general, across all the tested substrates.



Some limitations of this study included the constrained options for substrates available in pre-coated blanks, which hindered our ability to make additional side-by-side comparisons of other substrates or to expand the size of the color target used. We also did not use a reflectance standard on the spectrophotometer when measuring the metal substrates, which could have skewed our Delta E values. In addition, Delta E was an appropriate measure for this study since the intent was not necessarily to reproduce exact color patches. However, this measurement may not be suitable for

showing how the substrate color interacts with the printed color, and how it impacts the color measurement.

Recommendations for future research include utilizing ISO 12040:1997 standards (International Organization for Standardization) when analyzing light fastness. Finally, it may be beneficial to utilize a color proofing software with individual substrate baselines factored in to ensure that color profiles can accurately predict results when printing on different substrates.



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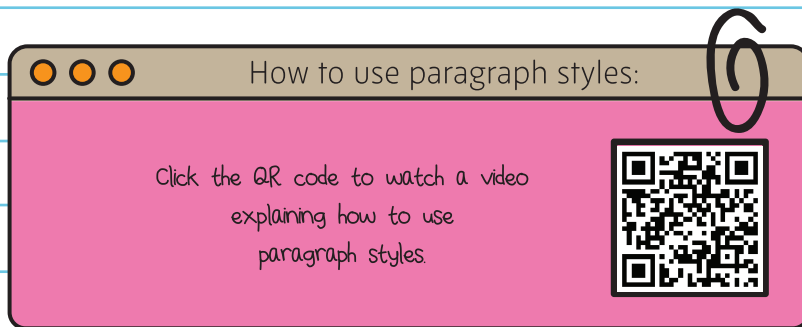
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<https://doi.org/10.1002/9783527687169.ch>

How to create a zip file:

Click the QR code to watch a video
with steps on creating a zip file.





Graphic Communication Degree offerings at Clemson University:

The Bachelor of Science degree in Graphic Communications prepares students for professional careers in printing, publishing, packaging graphics, digital media, content creation, and the greater communication industry. Our curriculum takes a holistic approach moving students from creative concept to actualization. With courses considering all major printing and visual communication processes, GC provides students with the opportunity to learn and grow in both an educational as well as a professional setting. Furthermore, the required specialty areas of study allow the student to develop in-depth knowledge and skills in specific areas of graphic communications. Coursework is heavily oriented around laboratory performance, which stresses the development of problem-solving skills in a broad cross-section of graphic mediums.

The M.S. in Graphic Communication program prepares students for technical, creative or professional careers in graphic communications, the third largest manufacturing industry in the United States.

The program serves the needs of graphic communications, graphic arts, printing management or graphic design graduates from other institutions.



CLEMSON



Clemson University's T.A.G.A. Course:

The Technical Association of the Graphic Arts is an international community of industry professionals and academics dedicated to scientific research and technological innovation in the diverse field of graphic communications. The Annual Technical Conference provides authors one of the premier platforms for communication, publication, and outreach in the graphic communications industry.

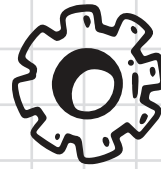
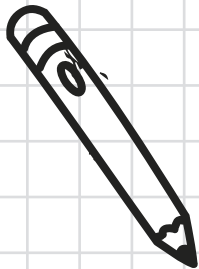
As a student chapter, Clemson University hosts a creative inquiry course where students are able to come together to design and produce a technical journal for submission to the international student journal competition. The journals are evaluated based on technical content, overall design, and production quality. Clemson University strives to produce all of their journals completely in-house using equipment available to students and materials either provided by generous donors and partners of the Graphic Communications department or purchased from outside vendors.

Home to Clemson G.C. students <3

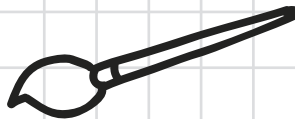
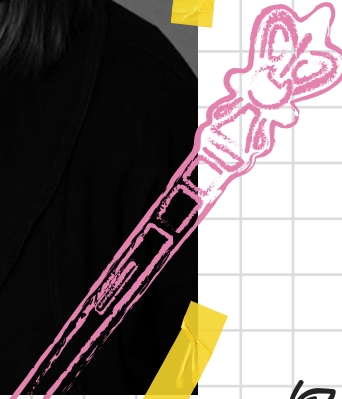




Senior



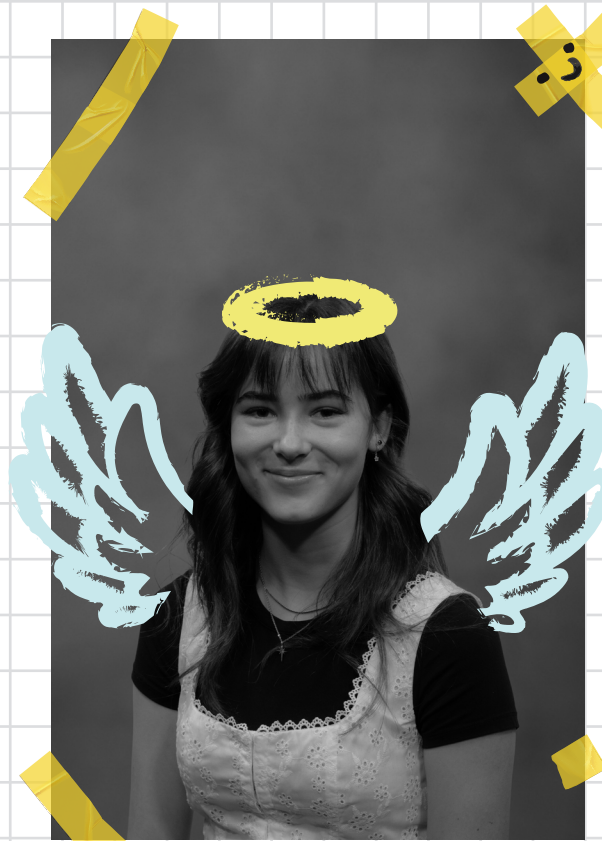
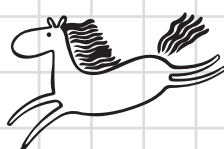
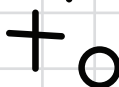
Professor



Dr. Amanda Bridges

Amanda Bridges joined the Department of Graphic Communications at Clemson University in Fall 2019. Prior to working at Clemson, she served as an Associate Professor and Graphic Design Coordinator at Gardner-Webb University. She has been teaching in higher education since 2004 and has taught a wide range of courses in graphic design, color and typography, web design, multimedia, and print production. She has also chaired and served on several university committees and advisory boards, as well as served as faculty advisor for several student organizations. She served as the Vice President of Communications for the Graphic Communications Education Association (GCEA) from 2021-2023. In addition, she has participated in a number of community service projects and enjoys incorporating service learning into the classroom. She currently serves as chapter advisor for the Technical Association of Graphic Arts (TAGA). Her current research interests include curriculum development and assessment in the fields of graphic communications and design. She is also conducting research in the areas of dye sublimation and direct-to-garment printing.

President



Madison Montgomery

Madison Montgomery is a junior at Clemson University majoring in Graphic communications. Madison is currently a full time student, a Teaching Assistant for a GC course, the President of TAGA, and a member of the equestrian team.

Madison completed her first two years at Converse University before transferring to Clemson University. At Converse she was studying to become a marketing major with a studio art minor.

Madison transferred to Clemson in her junior year of college, and was accepted into the TAGA course taught by Dr. Amanda Bridges. Before being apart of TAGA she was interested in a design and marketing route but TAGA helped blossom a passion for print.

During the summer of 2023, she got accepted as an intern at The Sonoco Institute. Madison was able to expand her knowledge of flexography and gain experience in the flexographic world. This internship allowed her to teach a short lecture in the Introduction to Flexography course and work alongside business professionals effectively and efficiently. Madison learned how to make plates, mount plates, set up the press for a run, clean up the press after a run, load substrates onto a web-fed flexographic press, use a densitometer to measure density, print with an extended color gamut, and learned about the many different substrates used at Sonoco.

Going into Madison's second year at Clemson, she was honored with the title "president."



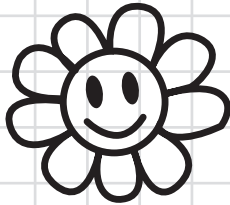
Vice President



Griffin Sanders

Hailing from Hilton Head Island, South Carolina, Griffin is the 2023-2024 vice president of our Clemson TAGA team and has been working as a freelance creative and graphics teaching assistant for three years. He really enjoys photo/video production and multi-media expression. Griffin has experience in the production industry on all sides. Working as a prepress intern for the world leader in transfer products and foil applications, Griffin had the opportunity to see many jobs from start to finish and really get a feel for the graphics and design field in a professional setting. Taking the lessons and skills from his internship, Griffin returned to Clemson and decided to join the TAGA team in order to further work in design and production. He also has been working very closely with creators in the Clemson / Greenville area to do extensive photoshoots, run video sessions, provide audio and voiceover recording help, and get as involved with production media as possible. When Griffin is not working in the printing lab, shooting videos, or attending class, he enjoys playing music and going outside. Griffin is excited to continue to work on the Clemson TAGA team and continue in graphics and multimedia production. After graduation, he hopes to either enter the graphics/production industry or get his master's degree at Clemson and stay in the Department of Graphic Communications as a part-time instructor.

C.G.



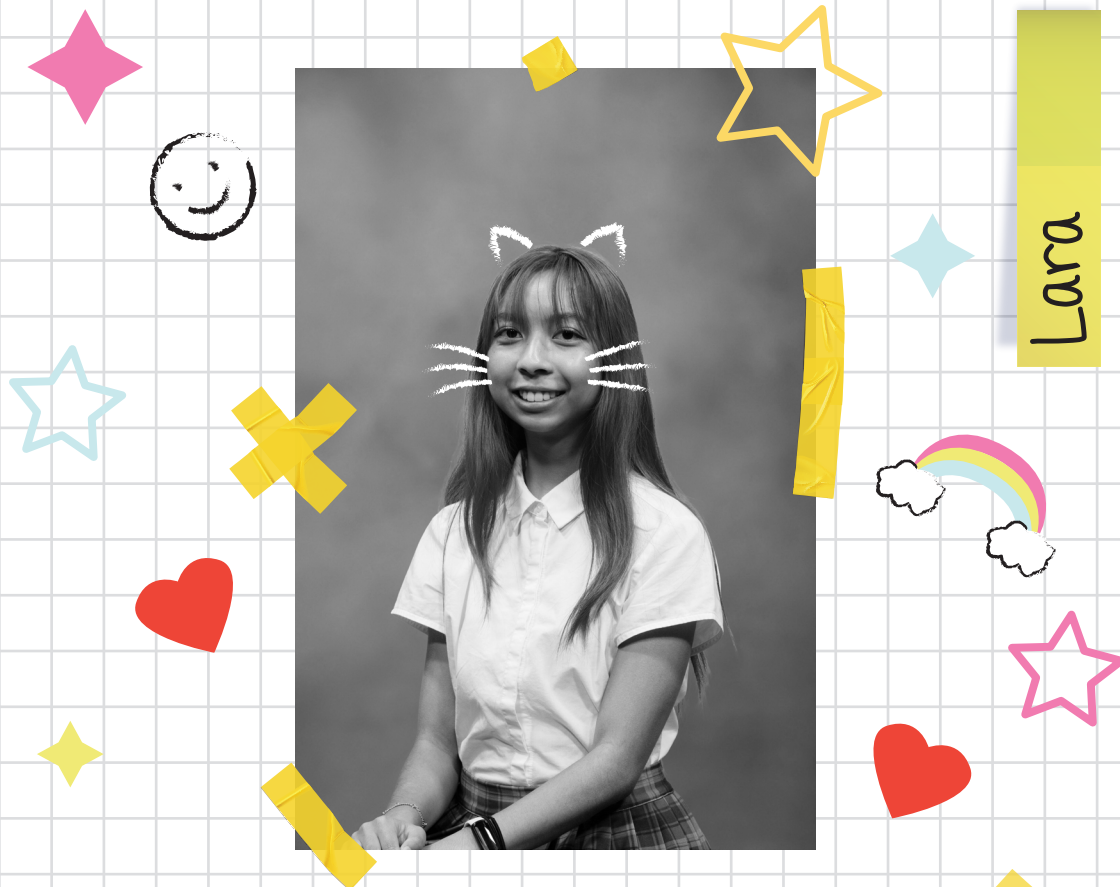
Chadley-Gray Schmidt

Chadley-Gray Schmidt is a Junior at Clemson University majoring in Graphic Communications and minoring in Business Administration. Chadley-Gray has been exposed to many different types of skills throughout her coursework and internships.

Her first part-time internship in Spring 2023 as a User Experience and Content Intern at Clemson's Student Accessibility Services taught her about web development, market research, and content writing. Chadley-Gray wanted to learn more about print production during Summer 2023 and took a full-time role as a Project Management Intern at AlphaGraphics South Charlotte. Here, she spent quality time in each production area and assisted in preplanning for new jobs.

Now, as a part-time Marketing Intern at Clemson's Pearce Center for Professional Communication, Chadley-Gray works with clients in the Clemson area to assist with marketing, public relations, and social media campaigns. Chadley-Gray credits the Graphic Communications department for teaching her to leverage her creativity and problem-solving abilities to develop impactful campaigns. She plans to pursue a career in marketing, with a focus in social media content creation.

Outside of school, she enjoys thrift shopping, seeing live music, and spending time with friends.



Lara Tijing

Lara Tijing is a junior pursuing a degree in Graphic Communications at Clemson University. At Clemson, she worked as a Visual Information Design Intern, a Teaching Assistant, and a Makerspace Intern. These roles have allowed her to gain valuable insights into various facets of design and assistance, laying the foundation for her career aspirations.

Lara's most recent full-time internship was at Graphics Solutions Group as a Marketing/Sales intern. For future jobs, she would like to work more in the creative side of the industry, such as graphic design, packaging, product design, content media and more.

Lara learned about creative careers when she enrolled in a Digital Art and Design course in high school. There, she discovered what she wanted to do and learned how to make it into a career. In high school, she had the opportunity to shadow a graphic designer at a small company. Their recommendation to explore Clemson University's Graphic Communications and package design courses resonated, and she took it to heart. She knew that Clemson was the place that could help me hone my skills and push my career in the right direction.

Beyond work and university, Lara has an interest in fashion and dance. Her creative outlets are creating new looks in my closet and learning new choreography. She loves to learn, be actively involved, and design!

Jada



Jada Young

Jada Young is a senior Graphic Communications major from Clemson, SC. The Graphic Communications program has allowed her to gain knowledge in graphic design, branding, and business.

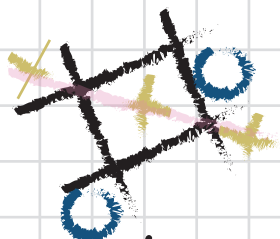
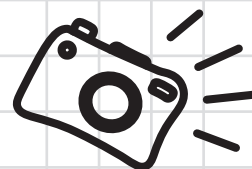
She's also gained majority of her knowledge in graphic design and printing processes through creative projects. While she's learned a lot in the classroom, she's also had the privilege of obtaining hands-on experience through internships. During her first internship with Marleylilly, which is an e-commerce monogramming apparel company, she worked as a Customer Service Intern. She resolved customer issues, processed orders, and worked in production. During her time at Clemson Online, Jada worked as a Graphic Design Intern. She designed social media posts, edited educational online videos, and used Adobe Creative Suite for various graphic design tasks. Both internships has allowed her to grow and learn more about the fields she'd like to pursue in the future. After graduation, Jada would like to earn her masters and work in the fields of advertising, graphic design, and marketing. She believes joining Taga will broaden her design skills, teach her new design techniques, and will increase her ability to work collaboratively within a team. She looks forward to learning more about TAGA and completing the design process with everyone!



Makenna Masters

Makenna is a junior at Clemson University majoring in Graphic Communications. Before Clemson, she attended Greenville Technical College and Tri-County Technical college where she majored in associate of arts, and was a part of NSLS (National Society of Leadership and Success). This will be her second year at Clemson University where she is a Tiger Transfer Mentor and her second year doing TAGA. This will be Makenna's first semester working on the digital side. However, she really enjoyed the production side, so she can't wait to learn more about the digital aspect that goes into the creation of the journal. Makenna really enjoys marketing and learning different ways to communicate an image. After graduation she hopes to use her graphic communications degree and go into advertising or sales. This past summer she received her first internship working for a non-profit as their graphic design and marketing intern. Throughout this internship Makenna was able to design web pages, event flyers, pamphlets, and more. She also was able to design logos that were collaborated with other companies in Greenville, SC. Makenna enjoyed managing the organization's social media sites and being able to work and network with other companies as well. After completing her internship she learned so many new design techniques as well as experience in marketing.

Catur Mae



Decatur Moore

Decatur Moore is a sophomore Graphic Communications major from the small town of Andrews, South Carolina. She is currently planning to minor in Historical Preservation over a summer in Historic Charleston, South Carolina! This is her first year participating in TAGA, and she is so excited to see what this year has in store and to learn and work alongside her classmates! Decatur is very involved with campus activities and student organizations holding two executive positions in the organizations she is involved in called Young Women for American and Be the Match. For these organizations, Decatur is in charge of photography, media, advertisement, designs, t-shirts, events, etc.

Decatur has a sincere passion for the printing process and wishes to explore a career in the industry. This upcoming summer, she plans to complete her first internship. She will be working with an LLC in her podunk hometown of Andrews, South Carolina. During this time, Decatur will gain experience in marketing, advertising, designing, and working with customers.

She is looking forward to learning more about the industry and getting a well-rounded, hands-on experience. The day to day of this would be organizing files, creating logos, flyers, social media posts, speaking with clients, and possibly even some pre-press work!

However, she has expressed that she would love to have the opportunity to get some experience in a significant variety of the printing processes.

Decatur said to tell you: "Thank you & Go Tigers!"



HELLO



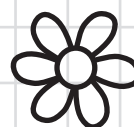
Nat



Natalie Hinson

Natalie Hinson is a senior Graphic Communications major with a minor in Business Administration. She has been a member of TAGA for two semesters. Last semester, she participated in the production semester of TAGA and worked on the videography/photography team. She is excited to be on the packaging team as well as the videography/photography team this semester. She is excited about leaving her legacy at Clemson in the GC program through her work in TAGA. Throughout her coursework she has also completed a graphic communications based internship with Tiger Properties in Clemson, South Carolina. Through this internship she was able to further her skills through her daily role as a Marketing Intern. As a marketing intern at Tiger Properties, LLC her daily role included various tasks such as social media management, on-site photography, and advertising. She assisted in creating engaging content for multiple channels, including social media and websites and helped to build brand awareness and drive user engagement. She gained valuable hands-on experience in managing content for multiple student housing properties such as Cambridge Creek, Villages at Town Creek, and Tiger Station in Clemson, SC. She is currently looking for her second internship which will hopefully continue into a job offer as she prepares to graduate in August of 2024.

Cassie



hi!

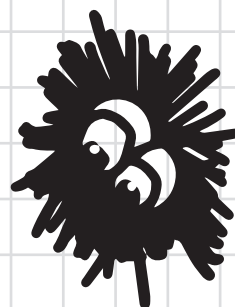
Cassie Craven

Cassie Craven is a sophomore at Clemson University majoring in Graphic Communications with a double minor in Brand Communications and Business Administration. She is a member of Gamma Phi Beta sorority Theta Epsilon chapter, a member in Clemson Women in Business, and in her second semester participating in TAGA.

Cassie had the opportunity to represent her team at the conference last year after being accepted into the class by Dr. Amanda Bridges. She helped in the production side of things during last Spring. The TAGA conference and everyone's passion showed her a love for print and therefore she is now taking on an internship next semester doing strictly print production. She is so excited to expand her knowledge and bring everything that she learns back to the team next fall.

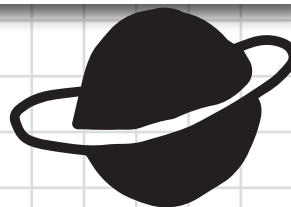
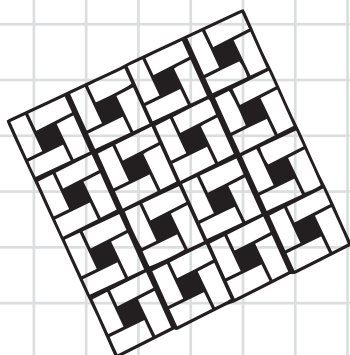


Zach

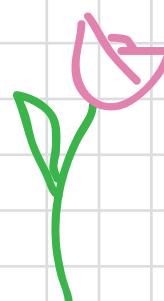


Zachary Walsh

Zachary Walsh, a senior coming from San Antonio, Texas, is pursuing a degree in Graphic Communications at Clemson University. This marks his first year as a member of TAGA, and he couldn't be more enthusiastic about being a part of the Clemson TAGA team. Zachary has a deep passion for teamwork and enjoys collaborating on various projects. Currently, he is employed as a web developer, where he creates websites for emerging and promising businesses. He is eager to apply his web development skills to benefit the team. Most importantly, Zachary is eager to see the valuable experiences and knowledge he will gain from his involvement with TAGA.



Carol



Caroline Myers

Caroline is a junior at Clemson University majoring in Graphic Communications and minoring in Business Administration.

Throughout her time in Graphic Communications at Clemson University, she has discovered a love for the printing process. She has really enjoyed learning about print production and the many different printing processes that exist. Caroline likes the hands-on aspect of Graphic Communications and how the faculty and students have grown to feel like family. Even though she is not exactly sure what she wants to do post-graduation, she knows that she wants to be in a hands-on environment. During her time at Clemson, she has become involved in the Graphic Communications academic fraternity known as Gamma Epsilon Tau. This has been a great environment to get connected with other GC students and to enjoy doing artistic activities together. When Caroline is not studying, she enjoys working out, spending time with family and friends, walking, and reading. She is also a huge advocate for the intramural program here at Clemson. She is super involved in it and enjoys playing soccer, basketball, and flag football.

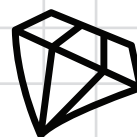
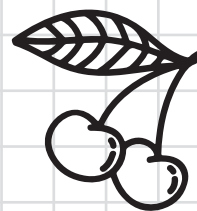
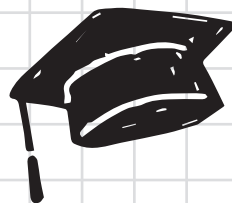
SOPH



Sophie Ayers

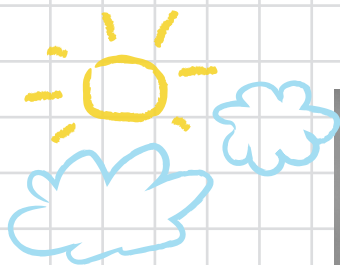
My name is Sophie Ayers and this is my second year in the TAGA program at Clemson University. I am a Junior Graphic Communications Major with a minor in Brand Communications and have loved the experience that TAGA has given me. I was part of the production team last year and I'm excited to be able to do both design and production this year. I hope to expand my design skills and knowledge and try new things with production this year. I was thankful to be able to work on designing the cover and provide the doodles on the binding for this journal. I'm very happy with how it came out and I'm excited to continue working with this team throughout my time at Clemson.

Maddie

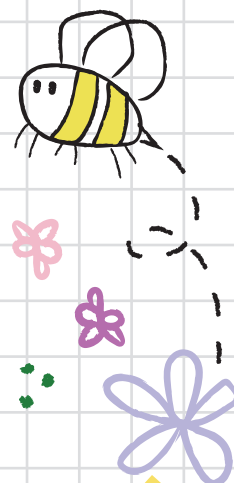
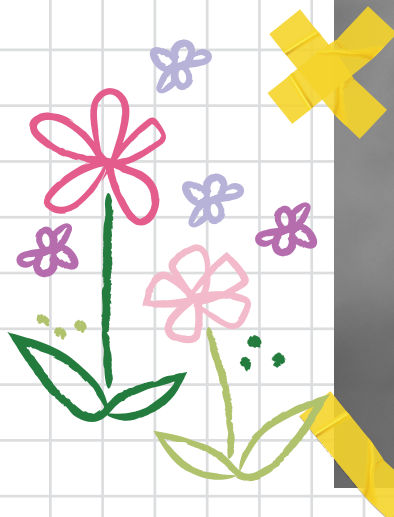


Madeleine Ossi

Hey! My name is Maddie and this is my first time doing TAGA! I'm a senior Graphic Communications major from Silver Spring, Maryland. I have completed both of my internships so far, my first in the Fall of 2022 with BMW's IT Center for the Americas in Greenville, South Carolina, and the other with Pivot, a direct mail / political consulting company based out of Washington D.C. I am so excited to gain more design experience through TAGA and create a book that we are all proud of!

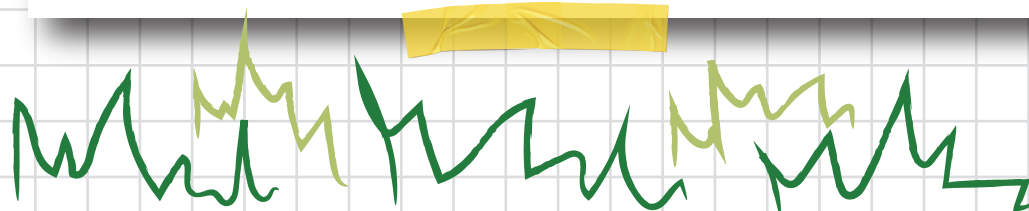


Rowan



Rowan Howell

Rowan Howell is a Sophomore at Clemson University majoring in Graphic Communications and minoring in Brand Communications. While she loves printing and learning how to run presses, the design side of Graphic Com has always been her favorite. She loves the entire creative process, whether it be brainstorming creative ideas, working with different applications, or facing challenges with curiosity and determination. She joined the TAGA team this year in hopes to expand, practice, and apply her design skills. She has since gained a lot more knowledge in packaging design and InDesign as well as soft skills such as collaboration, problem-solving, and communication. Rowan is involved in a few on-campus clubs such as Girl Up, the Clemson Fashion Club, and GET, Clemson's Graphic Communications Fraternity. Having grown up in Asheville, North Carolina, she loves hiking, the mountains, and fall weather. In her free time she enjoys thrifting, watching Formula 1, and spending time with friends and family. This Spring she plans to do a graphic design and social media internship to get real world experience in the industry. After graduation, Rowan hopes to get a masters degree in the Graphic Communications Department and in the future she hopes to work with packaging design and social media graphics and marketing.

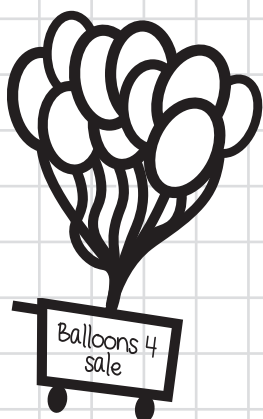
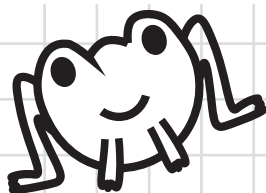


Lyss

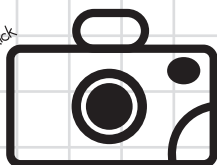


Alyssa Franck

Alyssa Franck is currently a sophomore at Clemson University planning to graduate with a Bachelor of Science in Graphic Communications and an American Sign Language Studies minor. Her experience at Clemson is providing her with a unique skillset to be proud of. As a GC major, students begin with an idea and work their way through the entire creative process until they have a final product. Whether Alyssa is working on creating a brand, bringing her designs to life with different printing techniques, or building a website for a client, she is constantly developing valuable real-world skills. Alyssa has improved her capabilities through the courses she has taken so far by pushing herself to take risks and always thinking outside-the-box. Beyond classes, Alyssa has interned at Roy Cox's photography studio in Baltimore and worked alongside the communication and marketing team as the social media intern for the company Eye to Eye's Young Leaders Organizing Institute in Denver this past summer. She looks forward to pursuing many more similar opportunities in the near future.



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Click



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Zachary Baskin

Hello! My name is Zach, or Zachary if you're fond of the extra syllables. I'm from Lake Wylie, South Carolina, and I am a sophomore Graphic Communications major at Clemson University. I'm excited to be in my first semester of TAGA for the Spring 2024 semester. I joined this semester because I was fascinated with the processes of putting the book that you are now reading together. I feel like I have always been a storyteller at heart, and bringing stories and ideas to life in a visual way is why I majored in Graphic Communications to begin with, so being involved in the production of this book and learning the process is very exciting for me.



Emily Taylor

Emily Taylor is a sophomore in Graphic Communications here at Clemson University. This will be her second year participating in TAGA, following her love for production and constantly learning new ways to hone and refine her skills. She takes time outside class to learn new ways of using all Adobe programs and explore new art forms. She is a teaching assistant to the Graphic Communications class, Applications of Digital Graphics, teaching others new ways to bring their imagination to the screen down to press! Emily continues to explore internships to learn everything there is to fulfill her future dream of owning her print shop.



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Keeli Coyne

Keeli Coyne is currently a sophomore at Clemson University in Graphic Communications with a minor in Business Administration, from Bloomfield Hills, Michigan. She is involved in Clemson Surf Club, CUBS, and is a member in Pi Beta Phi sorority! Keeli joined Graphic Communications because of her love of graphic design and artists like Andy Warhol. She enjoys learning and working in Adobe Illustrator and Photoshop, and learning photography.

She also is a TA in GC 2070; where she helps her fellow students in screen printing, cylindrical printing, and package design. This is her second semester in TAGA and she is thrilled to be back in this course, especially with such an amazing group of students! Keeli dreams of being a graphic designer and creating her own board game one day! Go Tigers!

XOXO



Alex



Robert Alexander Garrick

Robert "Alex" Garrick is a Freshman at Clemson University majoring in Graphic Communication. He is from the small, rural town of Bishopville, South Carolina. Alex is currently a full-time student and a member of Central Spirit. This is his first year participating in TAGA, and he is looking forward to all the opportunities it can bring to light. He is excited to expand his knowledge and skills into new areas and is always eager to try something new.

Alex cares a great deal about the creative process and the time it takes to fulfill that drive. In his career, he hopes to expand his capabilities into new and exciting areas. With his internships, he plans to accomplish these goals.



CASS

Cassidy Waites

Cassidy Waites is a sophomore Graphic Communications major from small town Newberry, South Carolina. Cassidy is a full time student at Clemson University, where she is a passionate member of Gamma Epsilon Tau, FCA, Tiger Vision, and Clemson Dancers. This is her first year as a member of TAGA, and she couldn't be more ecstatic to share her creative skills. She takes pride in being able to collaborate alongside her fellow classmates and gain more experience in design and production.

Cassidy has a genuine love for the graphic arts and design. She also thoroughly enjoys photo/video production and multi-media. Cassidy has been working as a freelance designer and photographer and currently serves as the graphic artist & sports media manager at Newberry Academy. Cassidy gets to work closely with the athletic teams and school administrators in arranging photoshoots, designing content for social media and apparel, video sessions, and producing signage. She also contributes in developing new marketing techniques. When she is not designing or taking photos, Cassidy enjoys spending time with family and friends, painting, taking in Clemson athletics, and yoga. After graduation, she plans to pursue a career as a graphic designer or a marketing manager.

Turtle



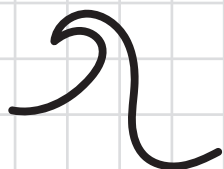
Madison Reeves

Madison Reeves is a sophomore at Clemson University majoring in Graphic Communications from Columbia, South Carolina.

Madison is a big fan of football and motorsports and plans to pursue a career in graphic design for an NFL team after college.

During her first year as a student, she participated in Clemson's Sports Marketing Internship Program, helping promote Clemson sports teams.

This semester is Madison's first time working in TAGA, and she plans on continuing her journey with the team!



Elli



Elli Delk

Elli is a senior Graphic Communications major from Lexington, South Carolina. Elli is a full time student in her last semester of college. She works part time at the Clemson bookstore as a cashier. Elli is a member of the Clemson Student Alumni Council, and has previously served as their director of public relations. She was also a member of the '24 Freshman Council, a '25 and '26 Freshman Council mentor, and was previously the First Friday Parade chair for her sorority. Elli also runs a small business making and selling birthday signs.

During the summer of 2022, she served as the full time photographer for Asbury Hills Camp & Retreat Center in Cleveland, SC. Responsibilities included capturing 500-800 photos of campers each day, and uploading photos to the Asbury Hills app daily.

In the fall of 2023, Elli accepted her second internship with Marleylilly in Greenville, SC. She served as the marketing/social media intern. Her responsibilities included creating photo and video content of merchandise for email campaigns, social media, and advertisements, tracking engagement across all social media platforms, and assisting the creative team and marketing team with various tasks.

This is Elli's first year as a member of TAGA, and she is thrilled for what's to come! In Elli's free time, she enjoys learning new recipes, playing golf and tennis, and playing with her cats. She is also a HUGE fan of Wheel of Fortune and Big Brother.

Smitty



Ashley Smith

Ashley Smith is a senior at Clemson University majoring in Graphic Communications. Ashley began her college experience at Sacred Heart University before transferring to Clemson University in the spring of 2021.

In the past two years she has worked as the PR Chair for Delta Zeta where she directed photoshoots, created graphics used throughout formal recruitment, and helped organize the social media calendar.

Ashley also works as a freelance photographer and graphic designer, expanding her knowledge in production, social media scheduling and content creation. She communicates with clients in order to execute their desired vision, edits, and presents their sessions on her online website portfolio where it is easily accessible.

In the spring of 2023 she was accepted as an intern at TCS (The Color Spot) in Columbia, South Carolina. Throughout her internship she worked closely with director Andy Markl on campaign development, print production, and numerous other projects within the Columbia area. She developed skills in driving leads to management, created 30+ campaign graphics, and looked into the importance of product and service drip marketing.

Going into her final fall semester at Clemson University, Ashley is eager to explore more within the marketing and graphic communications field, applying her knowledge and skills in the work force.



Tristen



Tristen Moss

Tristen Moss, a vibrant sophomore enrolled in Clemson University's Graphic Communications program, is navigating her academic journey with a keen focus on visual storytelling and design innovation. Currently immersed in the vibrant atmosphere of Clemson's Campus Recreation department, Tristen assumes the role of a dedicated intern, channeling her creative energies into diverse graphic design projects. While her heart lies in the captivating world of design within the graphic communications program, Tristen is also fueled by a curiosity to explore the intricacies of the print aspect, seeking a holistic understanding of the field. Driven by an unwavering passion for creativity and effective visual communication, Tristen doesn't just view her internship as a task but as an opportunity to refine and elevate her skills to create a lasting impact. In anticipation of the upcoming summer in 2024, Tristen eagerly looks forward to securing an internship, envisioning it as a crucial stepping stone in her quest to gain hands-on experience and delve deeper into the dynamic and evolving landscape of graphic communications. Her aspirations extend beyond the academic realm, aiming to contribute significantly to the industry and emerge as a proficient professional in the field.

FOZ



Foster Rouse

Foster Rouse is a Junior at Clemson University majoring in Graphic Communications and minoring in Business. This is Foster's second year participating in TAGA and he looks forward to managing the website this semester. His primary background is brand design but he enjoys expanding his print skills by participating in production through TAGA.

During summer of 2023, Foster worked as the graphic design intern for ImageMark Business Services. Along with design work during his internship, he worked on developing an online digital storefront for purchasing business cards and other custom printed materials. In addition to this, Foster had the opportunity to broaden his skillset with wide format printing.

"I am honored to once again be a part of this team and cannot wait to see what we can accomplish!"

100

OFFSET LITHOGRAPHY?

- Offset lithography is a print process where an image is transferred (off set) from one cylinder to another where it's then pressed onto paper.

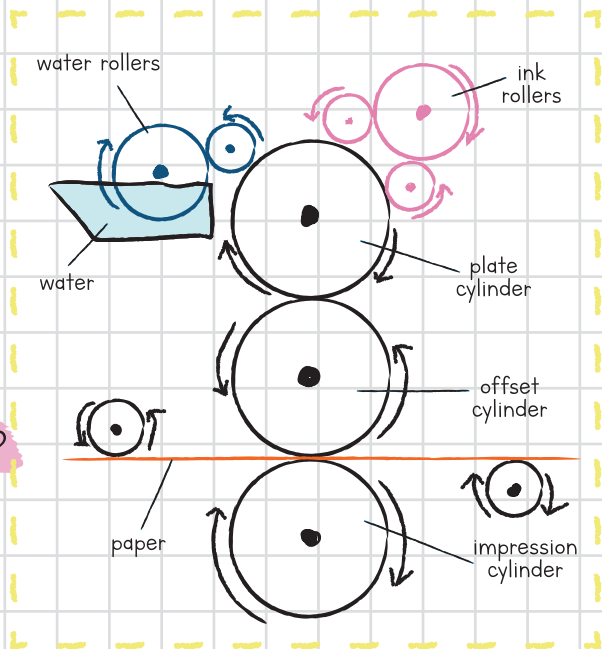
Basic Concept

- Image Carrier: a design is drawn with greasy crayon or ink on a flat limestone slab, to which the crayon adheres.
- Dampening: the stone is then moistened with water which is absorbed by the parts of the stone not covered by grease.
- Inking: using a roller, greasy ink is applied to the stone – the ink adheres only to the drawing and is repelled by the wet parts of the stone.
- Impression: a print is made by pressing paper against the inked stone drawing.
- Drying: the paper and ink are allowed to dry.



Water Rollers

- Lithography works on the idea that oil and water do not mix. Water rollers pick up water and transfer them into the non-image area so that the oil based ink only fills into where the image needs to be.



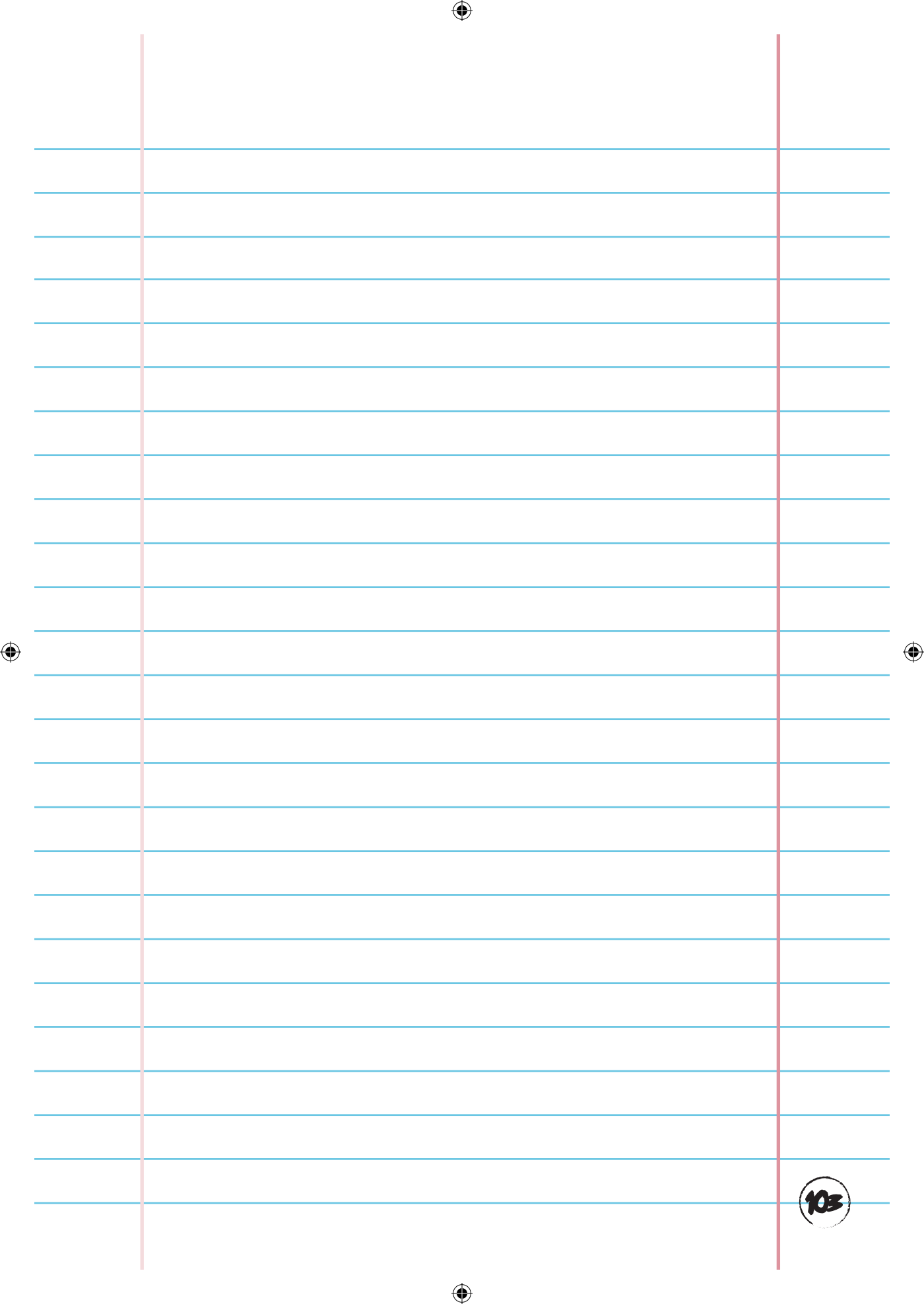
What Does Offset Print?

- books
- magazines
- newspaper
- stationary

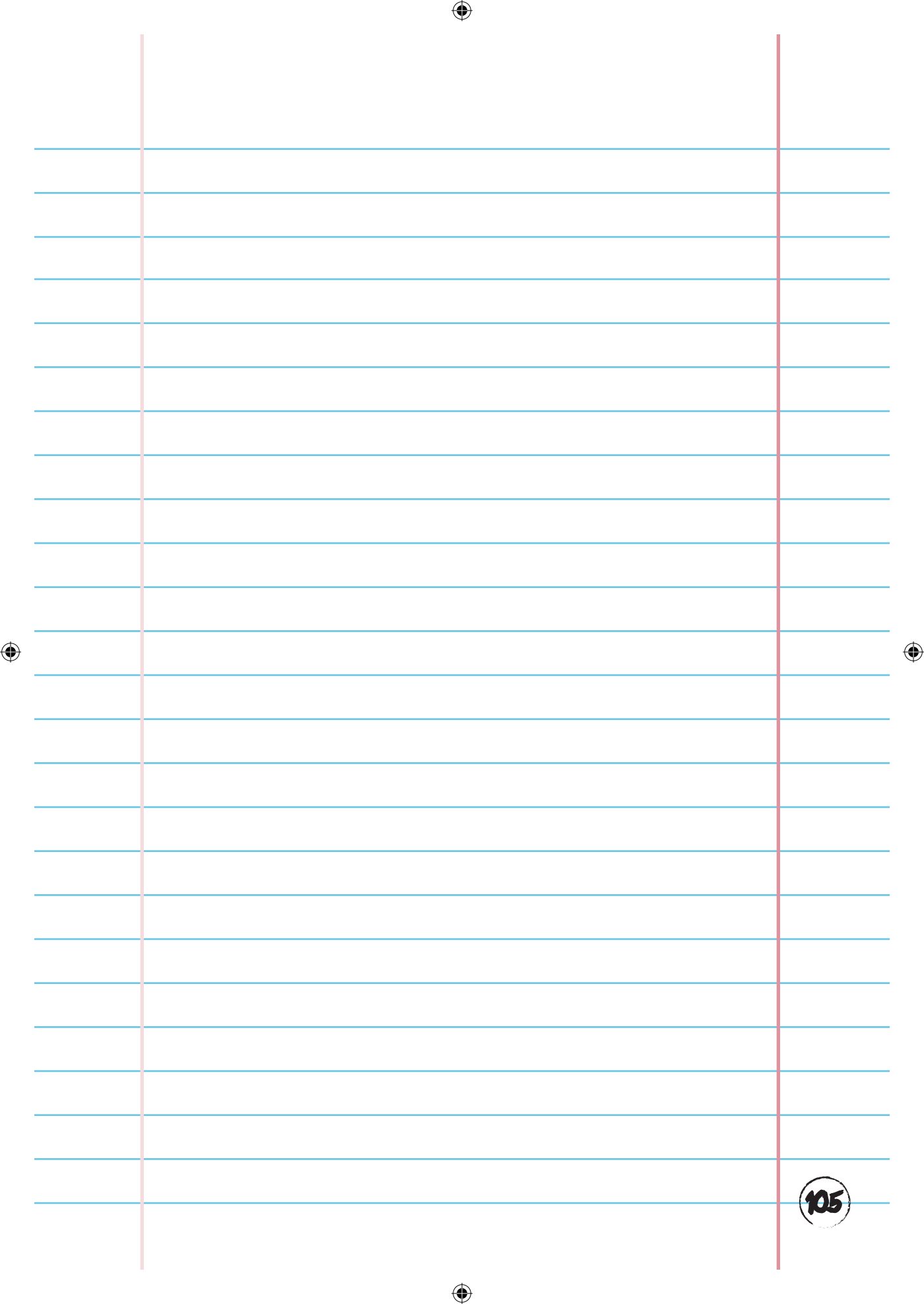


YOUR SURVIVAL GUIDE:

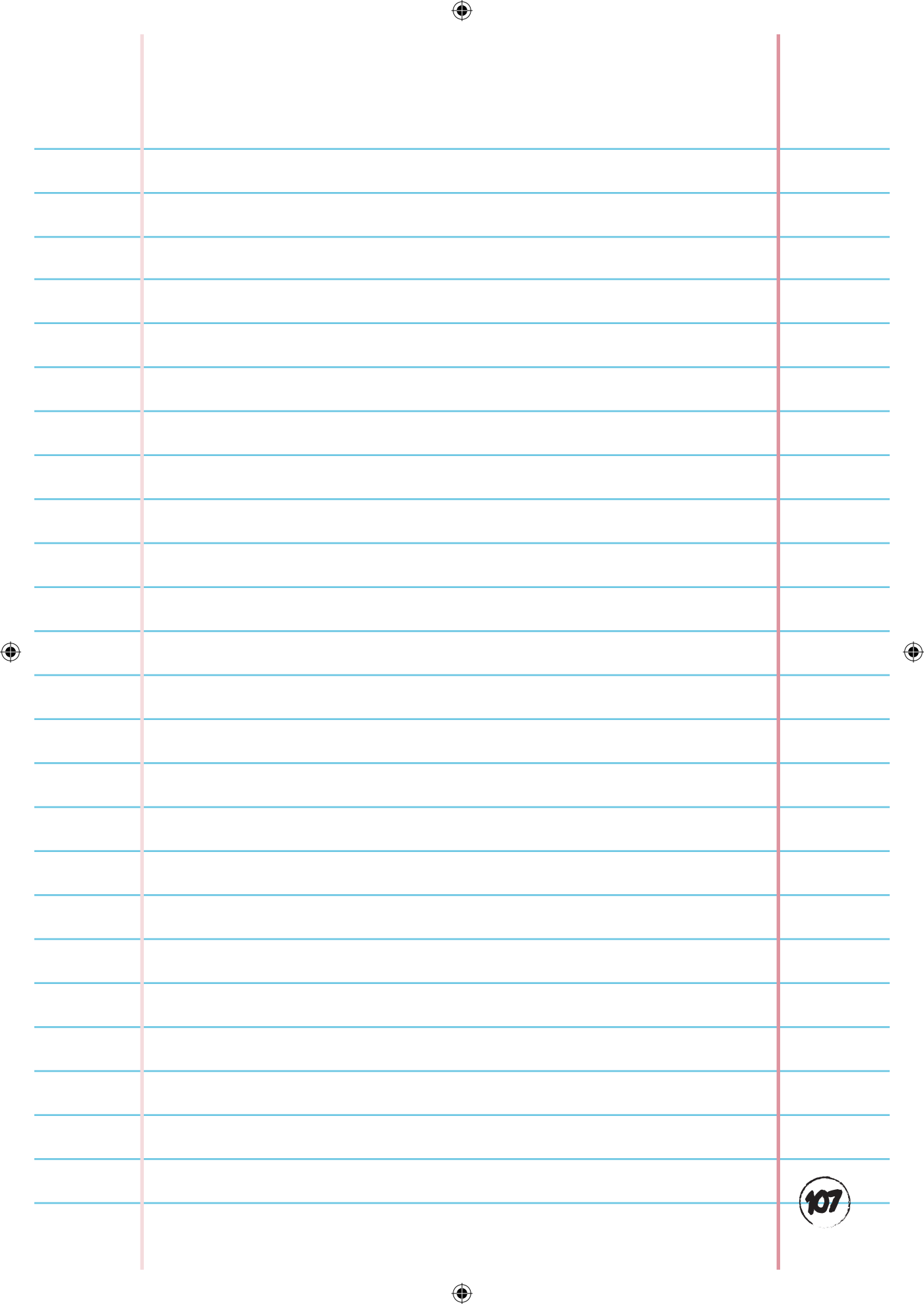
PERSONALIZE THE REST OF THE BOOK WITH YOUR OWN NOTES!











DIGITAL PRINTING

What is it?

- Digital printing is the process of printing digital-based images onto a variety of media substrates.

What makes digital different from offset printing?

- There is no need for a printing plate.

Advantages of Digital Printing:

- Print runs quickly
- Cost-effective
- Ideal for variable data printing

What inks are used in digital printing?

- CMYK
 - Cyan, Magenta, Yellow, and Black (Key)

What types of digital printers are there?

- Heidelberg Versafire CM
- Konica Minolta AccurioPress C6100
- Ricoh Pro C700S
- Xerox Versar 180 Press
- Sharp MX-7090n

What is powder toner?

- Synthetic resin
- Pigments (color)
- Magnetize metal oxides
- Various auxiliary substances



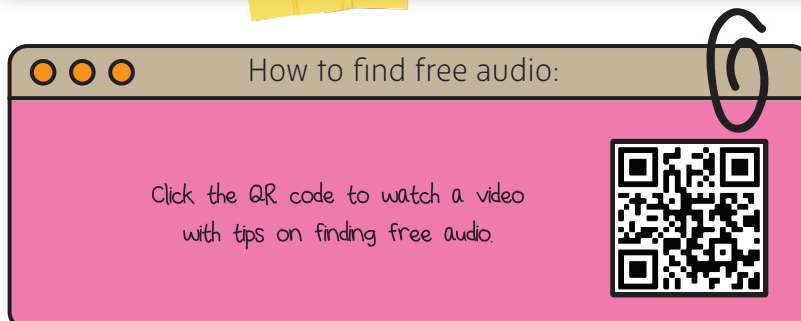
(POWDER TONER)

What materials do you need to digitally print?

- Image that is ready to be printed (typically a pdf file).
- Material that is used for printing
- A digital printer

How to print digitally using the Konica Minolta:

- Create a design based on the requirements and instructions.
- Once the design has been through the proofing stages make sure that your design is in the correct file format and correct resolution
- If necessary, do a cleaning run through the printer.
- Upload the proper file to the print server.
- Once the file is in the server, adjust the paper size, paper tray, and other settings
- Hit print.
- You now have your finished product :)



PRODUCTION NOTES

All design, digital, and production elements of this journal have been produced by this year's Clemson TAGA team. Our students have worked tirelessly to produce this journal completely from start to finish.

A special thank you to the graduate students, Ramya Potnis and Riley Dekrafft, that assisted, as well as our beloved professors who allowed us to include their research in this year's journal. We would also like to thank Clemson's Dr. Amanda Bridges for leading our team, as well as Mr. Brian Frederick, Dr. Eric Weisenmiller, Mrs. Hanna Gilreath, Ms. Michelle Fox and Mr. Ian Ruff for assisting the team with the use of the machinery in our lab.

As well as a big thank you to Haley Appleby in the Packaging Science department who assisted us in printing and designing a functioning and sustainable product package.

Binding:

To bind our journals we utilized our Fastbind Elite XT Manual Versatile Perfect Binding Machine.



Design:

When designing our journal, we used several Adobe Creative Suite products such as Adobe Illustrator, Adobe Photoshop, Adobe Acrobat, Adobe Lightroom, Adobe Premier, Adobe Aero, Adobe Lightroom Classic, Adobe XD, Adobe After Effects, and Adobe InDesign. We also utilized our ImposStrip software to create the imposition layout for the printing of our journals.



Digital:

To create the digital elements for our journal we used Adobe Premier to edit videos, Adobe Illustrator to create multiple spreads, Adobe XD for QR codes, Wix site to create our website, as well as using Adobe Illustrator and Adobe Photoshop to create several elements on our webpage.



Package:

With the help of the Packaging Science Department at Clemson University, our packages were produced using E-flute corrugated board, the Fujifilm Acuity Select 26 printer and the Kongsberg C24 Edge cutting table.

T-Shirt:

We printed our t-shirts on our Direct to Garment Roland VersaStudio B-12 printer. We utilized our screenprinting equipment to print "TAGA" using Rutland Plastisol Ink, Rutland NPT Puff Additive, Kiwo Plastisol SB2 Dual-Cure Emulsion, Franmar STRIP-e-doo Emulsion Remover, ICC 856 Spray and Wipe, ICC 877 Ink Degradent, pre-stretched 305 yellow mesh screen, Lawson LED-5000, Kodak Trendsetter NX Mid, and Kodak D1TR 18 lb Film.



Cover:

To produce our covers we ran Grocer Kraft 17 point raw environment paper through our HP Indigo 10000 and printed the title text in pure black.

Spine:

For production of our spine labels we produced our Dupont Cyrel DFR 067 Mil photopolymer printing plates on the ESKO CDI Spark 2530 imager. They were exposed on the Dupont Cyrel FAST exposure unit and developed on the Dupont Cyrel 1000TD Thermal Developer. The plates were mounted onto plate sleeves using the JM Hereford plate mounter. We ran the labels on the Nilpeter FA-Line flexographic printing press. The labels were cut by hand by our team.



Interior Pages:

The interior pages were produced by our Konica Minolta AccurioPress C6100 using Cougar Super Smooth 8/32 lb paper.

THANK YOU FOR READING!

We hope you enjoyed our journal and that it helped bring you closer to
"surviving" Graphic Communications!

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Alex Carter

Foster Rouse

Emily
Taylor

Zachary Baskin

Justin
Moss

Elli Delb

Justin Reeuwé

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