Designing a specific Course to enhance Printing Quality of Graphics & Images in lithographic Printing

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Abstract
In a college course about designing visual media such as photography and desktop publishing, it was found that there is a great need to develop a method for raising printing quality; this method should meet the demand of evaluating the student's performance and comprehension after each step in the course plan. This need came from the knowledge of the nature of Lithography Printing as a subject that employs more than color quality or image perception, student are asked to perform the practice of applying the theoretical terms of elements of quality control (dot gain, line sharpness, bleeding, color ink coverage, and etc.) into the technique of using these elements in relation to each other and combining them into meaningful wholes through designs that will apply visual design principles (such as balance, emphasis, contrast, and movement) considering certain criteria such as effective color combination, type style and attention-getting visuals, in these designs which will be addressed to audiences to have certain effect on them (to appeal to target audiences successfully) which mean that they must have the ability to use the design fundamentals in a creative way not just repeat the theory. Just as grammars of language do, visual grammar will describe the way in which depicted elements of the visual design combine in visual statements of greater or lesser complexity and extension.

Keywords
Lithography Printing, Quality Control, Visual media, Graphic Design, Visual grammar, Media elements

Introduction
Our approach in this research is how to develop the use of quality control in lithographic printing to enhance the quality of image, text and graphics as instructional methods and how to use them in effective design for college design program. We recognize that it’s not the medium that causes learning. Rather it is the design of the lesson itself and the best use of instructional methods that make the difference. A learner-centered approach suggests that we design lessons that accommodate human learning processes regardless of the media involved [10]. We suggest the subject "Quality Control Principles" as an example for teaching printing by e-learning. Since a finished printed image generally consists of the overprint of the four halftone screens, it is very difficult to isolate each of the various components affecting the reproduction of the original image. To overcome this problem, a series of test elements can be printed along with the image, and each element can be designed to highlight a particular aspect of the printing process. While some of these test targets can be evaluated by eye, others require the use of a densitometer. The usual form of these test elements is a strip across the edge of the press sheet, although in boxboard and label work these elements may be interspersed with the images. These test strips, called print control strips or color bars, are available commercially from FOGRA, BRUNNER, etc. and consist of strips of film containing the various test elements for each of the four colors. In some cases six color versions are available when special colors might be used. The usual densitometric targets in a color bar are: Solid Ink Density, Dot Area/Gain of the quarter, half and three-quarter tints, Contrast and the Trapping of ink overprints.

Objectives
On completion of this course students should be able to: recognize the total quality of print out,
analysis designs into their primary elements, use the design principles and employ them into visual designs such as graphics, photography, or Typography

- Enhance printing quality of lithography
- connect practice and theory of design
- apply critical analysing skills to the practice of Design, and the resolution of theoretical issues relating to it
- analyze the ratio of total quality of design in lithographic printing

Analysis

The course has 3 main elements, which will be implemented to achieve students' ability to control quality and design using images, text and graphics:

1- Elements of design (point, line, surface, etc.)
2- Basics of Quality control tests for lithography
3- Employ design elements to create certain strategies of visual relations which we can call design principles (balance, mass and space)
4- Applying design principles into visual design which include (image design, typography and graphic design)

Planning

Based on course outcomes, student should have the ability to control printing quality and make visual designs using design strategies and apply these strategies. The suggested course outline:

Lesson 1: Density: students will learn Absolute density is the measured density of the ink sample including the substrate or base, while relative density is the density of the ink sample minus the density of the substrate.
Lesson 2: Chromatic Balance (gray balance): students will learn the color balance of the job for the combination of press, paper and ink being used.
Lesson 3: Dot Gain: Students will learn to monitor the way the dot is reproduced. As the image progresses through the reproduction process from film to plate, plate to blanket and finally blanket to paper, the size of the dot changes.
Lesson 4: Print Contrast: students will learn to measure the ability of the printing process to hold shadow detail.
Lessons 5 & 6: Trapping: students will learn to measure of how well the inks are adhering to each other.
Lessons 7 & 8: Graphic and Photographic elements: students will learn to recognize elements of design -discussed in lesson1- in the photographic image and practice the process of analyzing images into visual objects in relation to each other.
Lesson 9: application: students will learn to recognize density of printouts -discussed in lesson1- in the graphic design and practice the process of analyzing the results of lithography print out.
Lessons 10 & 11 & 12: Practical Exercise: students will learn how to apply quality control principles to control their own printout and how to follow up their project in appropriate way using images, typography and graphic figures into a complete visually appealing design. When creating their own poster designs students will not only learn to consider effective color combinations, type styles, and attention-getting visuals, but also how to enhance the printing quality. Design the various materials for this course are indeed the elements of the course; students will learn the design principles by means of using graphic shapes to represent the theoretical ideas. See examples of work use directional lines to analyze the image into elements and relations.
I. Analysis of Quality Control Items

**Fig. 1. Density**
The capacity of a printed color to absorb light (opacity) and therefore not to reflect it, expressed in a logarithm way (at basis 10) to conform it at the discerning rule of the human eye.

**Fig. 2. Dot Gain**
Defined as the increase in the diameter of a halftone dot during the prepress and printing processes. Total dot gain is the difference between the dot size on the film negative and the corresponding printed dot size. For example, a dot pattern that covers 30% of the image area on film, but covers 50% when printed, is said to show a total dot gain of 20%. However, with today's computer-to-plate imaging systems, which eliminates film completely, the measure of "film" is the original digital source "dot." Therefore, dot gain is now measured as the original digital dot versus the actual measured ink dot on paper.

**Fig. 3. Module 1**
Contains the process color solids, i.e. cyan, magenta, yellow and black as well as three overprintings with two separated colors each and a three-color superimposed print. These patches help to control the ink acceptance and the three-color superimposed printing. Each color name is indicated above the patches with a character in the corresponding separated color. Besides the overprinting of the separate colors module 1 contains a patch with a 300 % dot area of separate colors cyan, magenta, yellow and a white dot area in a black frame. At the beginning of module 1, there is a patch designed IND (indicator patch). It informs the user of the Ugra/Fogra EPS-PCS V1.6 whether the output device in use (digital proofer, film or platesetter) is in compliance with the BVD/Fogra standard the patch shows horizontal lines in one half and vertical lines in the other half, we can assume that the standard requirements are met with. This patch should appear without lines, the Ugra/Fogra EPS-PCS V1.6 user ought to check first the conformity with the standard requirements (screen 60/cm circular dot) on the midtone patches of module 2.

**Fig. 4. Module 2**
Module 2 is composed of balance, solid, D and halftone patches with 40 and 80% tone values. For the balance patch, grey conditions related to the film output on cyan with 75%, magenta with 62% and yellow with 60% have been defined. A halftone patch with 80% tone value is fed in black for comparison. The solids, in the order of sequence black, cyan, magenta and yellow, are repeated every 4, 8 cm. The first black solid next to the balance patch contains a yellow overprinting in the four corners. This helps to determine whether yellow is indeed the last down color. 3 D patches of merely 4 mm width and 6 mm height each contain line screens with 0°, 90° and 45° angles. The screen ruling is determined individually according to the setting of the output device, the resolving capacity and the computing accuracy of the RIP. For all the angles, the tone value is 50%. 40% and 80% patches with a screen frequencies of 60/cm (150 lines/inch) are defined in the halftone patches. They are labeled with the corresponding process colors.

The print contrast is inversely proportional to the gain. The increasing of contrast increases also the print quality.

Fig. 4. Print contrast (K)

Fig. 6. Trapping
It is the ability of the first ink down to accept the next ink and of the second printed ink to be overprinted to the first down. Clearly it is better in the case of an overprint "humid over dry" instead of "humid over humid".
II. Visual Analysis of Design
There is no better way to begin to view the analysis of graphic design, illustration, architecture, and industrial design than with an introduction by Le Corbusier. Corbusier's revelation is one of that's of value of all artists, designers, and architects. The understanding of the underlying organizational principles of geometry brings to a creative work a sense of compositional cohesiveness, whereby each element of the work has a visual sense of belonging. By revealing some of the geometry, systems, and proportions it's possible to understand better the intent and reasoning of a number of designers and architects. It gives insight into the process of realization and a rational explanation for many decisions, whether the use of organizational geometry is intuitive or deliberate, rigidly applied or casually considered [5].

![Fig. 5. Der Berufsphotograph Poster, Jan Tschichold](image)

The negative photograph is just to the right of the center of the root 2 rectangle format. The left eye of the figure is carefully placed and the image cropped so as to become the nexus of diagonals that regulate the placement of elements. The measure of the width and depth of the image is echoed by the typographic elements to the left. [5]

![Fig. 7. Close to the Edge (Markedly eccentric, needing some justification)](image)

![Fig. 8. Slightly off-center (Moderately dynamic, without being extreme)](image)
Practically there are three zones in a picture frame for placing a single dominant point. A point has to have basic relationships with the frame. In one, there are implied forces that are in proportion to each corner and side. In the other, implied in lines suggest a horizontal and vertical division of the frame.

Fig. 9. Diagonal Tension

The Dynamic movement in this wide-angle photograph comes from the interplay of diagonals with the rectangular frame. Although the diagonal lines have independent movement and direction, it is the reference standard of the frame edges that allows them to create tension in the picture [8].

Fig. 10. Diagonal lines vs. horizontal lines

Horizontal and vertical lines when correctly aligned to the frame create a sense of stability relative to a normal viewpoint. Diagonal lines are not relative to the normal perception of stability and are therefore viewed as unstable and precarious. Whether actual or perceived the visual tension created by the use of diagonal lines can lead to dynamic composition and a sense of movement within the image [7].

Implementation

Execute all the above course materials, packaging, publishing and installing into LMS (learning content management systems). Typically instructional design and the creation of media assets receive the sole emphasis, while crafting an effective interface between the student and the content is left to chance. The interaction between students and computers in the field of e-learning in some cases becomes nearly impossible because of design problems such as: confusing menus, unclear buttons, or illogical links that scare them off. The success of any training program is largely dependent on the student's own motivation and attitude. If a poorly designed interface has them feeling lost, confused, or frustrated, it will become a barrier to effective learning and information retention. Visual perception, a problem and a solution Perception is an aspect of human behavior, and as such it is subject to many of
the same influences that shape other aspects of behavior. In particular, each individual’s experience combine in a complex fashion to determine his reaction to a given stimulus [6]. After recognizing an observed picture, one has matched it to a stored representation of the pictured object or scene, and knows only that it is familiar. This matching process is exclusively visual, and it does not result in a name or any other information. In contrast, after identifying an object, one has access to the entire range of information associated with it, [11]. There has been a revolution in our understanding of human perception that goes under the name “active vision.” Active vision means that we should think about graphic designs as cognitive tools, enhancing and extending our brains. Although we can, to some extent, form mental images in our heads, we do much better when those images are out in the world, on paper or computer screen [2].

If we understand the world through just-in-time visual queries, the goal of information design must be to design displays so that visual queries are processed both rapidly and correctly for every important cognitive task the display is intended to support. This has a number of important ramifications for graphic design. The first is that in order to do successful design we must understand the cognitive tasks and visual queries a graphic is intended to support. This is normally done somewhat intuitively, but it can also be made explicit [2]. Effective design should start with a visual task analysis, determine the set of visual queries to be supported by a design, and then use color, form, and space to efficiently serve those queries. Skilled graphic designers already do this intuitively [2]. Unfortunately most of design students did not attend courses in visual perception, and the mechanism of visual perception is not clear for them, most of them complain that they know the principles and elements of design in theoretical words from lectures but with no practical experience, they learn to use those tools during their study by making mistakes and the teacher will have to explain individually those mistakes which makes an obstacle in the efficiency of the learning process. The other main problem is that individuals in the design class have different "cognitive styles" [9], they have certain differences in the way they perceive and process information. We suggest that e-learning will help us to develop courseware that meet our needs of interactivity between the design student and the course material, this way the teacher will be able to measure the student's comprehension of the theoretical terms of design and his ability to analyze any design to its elements and make his own design based on the knowledge of design elements and its effect on visual perception. It is vital to examine how different learners perceive the features of any learning and specially hypermedia learning. Evaluation of learners’ individual differences become paramount because such evaluation can provide solid recommendations for designing and developing hypermedia learning system that can match with the particular needs of each learner [9].

Conclusion

Designing a courseware teaching visual perception for Printing and Design Students that depends on interactivity between the student and the course elements to examine students ability to understand and apply the theories of Quality Control in printing and visual perceptions in designs using the elements of quality control and design to produce a higher quality results in lithography and a successful visual communication through design in photography, publishing and printed materials.

References