

Automatic Design of Magazine Covers [#]

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ABSTRACT

In this paper, we propose a system for automatic design of magazine covers that quantifies a number of concepts from art and aesthetics. Our solution to automatic design of this type of media has been shaped by input from professional designers, magazine art directors and editorial boards, and journalists. Consequently, a number of principles in design and rules in designing magazine covers are delineated. Several techniques are derived and employed in order to quantify and implement these principles and rules in the format of a software framework. At this stage, our framework divides the task of design into three main modules: layout of magazine cover elements, choice of color for masthead and cover lines, and typography of cover lines. Feedback from professional designers on our designs suggests that our results are congruent with their intuition.

Keywords: Design, Automatic, Aesthetics, Magazine Cover, Color Design, Typography, Style, Principles in Design

1. INTRODUCTION

1.1 Motivation and Statement of Problem

With progress in technology, the idea of communication has been evolving. Personal communication has been enriched by means of internet web services such as web blogs, forums, and web magazines. There are several tools that contribute to the creation of a self-publishing medium for the sake of communication over internet. These tools support semi-automatic/automatic composition of media. However, the idea of personal communication over the internet by means of self-publishing is multi-dimensional. One of the dimensions is to support individuals or small to medium businesses to publish by designing media. Aesthetics is an important aspect of such media. Therefore, designing aesthetically pleasing media is a conspicuous challenge that semi-automatic/automatic tools must address [1]. The main audience or customers of these tools are non-designer designers. Two examples of such tools are autophotobook.com [2], that helps users to generate appealing photo albums, and autogreetingcard.com [3], which provides a tool to compose personal greeting card. Recently, the idea of web magazines has been a focus of web service providers. Magcloud.com [4], for instance, supports users to publish magazines and advertisements for either web or print. Automatic design of magazines discussed in [5] is another example of such efforts. Automatic design of magazine covers is another concept that can be deployed to support current and future self-publishing work. It can also contribute to new approaches to automatically designing documents and media.

Our purpose in this paper is to address the idea of automatic design of magazine covers. If we can quantify and model this process, we can support non-designers to produce designs that are closer to the work of professionals. This new idea is however a multifaceted problem which includes the autonomous process of design, aesthetics and principles of design, concept in design, and cultural considerations in design. We are interested to know how professional designers think in the process of creating a magazine and how they create a cover considering the form and the functionality of it. Since automatic design of magazine covers needs to be approached in an interdisciplinary manner, we have contacted professionals in schools of art, schools of journalism, and magazine editorial boards. We have performed a literature review in the areas of computer science and engineering, art and graphic design, and journalism. A number of interviews with professional designers have been conducted as well. We have then implemented what we have learned in a framework of a software tool. The collection of our work is presented in this paper. The paper is organized as follows:

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Section 1.2 discusses the analysis of the contents of a cover. Section 2 describes our solution to automatic design – algorithms and methods devised to implement our ideas. Section 3 presents some of experimental results from our system. Section 4 discusses the limitations of our automatic design and future work. Finally, Section 5 provides a conclusion for our work at this stage.

1.2 Analysis of Magazine Cover Contents

In order to address the concept of magazine cover design, one needs to know what are the elements of a magazine cover. In fact, the elements of the magazine cover customize this type of design and make it different from other media such as posters or brochures. References [6] and [7] identify the structure and elements of magazine covers through analysis of well-known magazines and interviews with professionals. As Figure 1 illustrates, a magazine cover consists of a cover image, masthead, cover lines, price, date, barcode, and some graphics called bells and whistles.



Figure 1. Elements of a magazine cover (image from [8]).

The following is a list of magazine cover elements with a concise description of the form and functionality of each element from [6].

Cover Image: It is probably the most important element of the cover. Art directors, editors, and publishers have many disputes about the cover shot, since it has a crucial role on making the sale. Some research delineates that making eye contact between readers and the person on the cover contributes enormously to the sale, although sometimes designers may use an unusual shot to make the issue stand out from competitors.

Masthead: The masthead contains the title of the magazine. It has a fixed design which contributes to making it to be iconic. Its typeface is fixed. However, its color or perhaps its size may change. An iconic (familiar to consumers) masthead gives a degree of freedom to the designer to break some of the rules about the cover’s masthead.

Cover Lines: The main function of the cover lines is to absorb the reader’s interest, and to convince him or her to purchase the magazine instead of a competing magazine. Cover lines also give a flavor to readers about the class of magazine. Here, the form of typeface matters. A formal typeface indicates different content than a casual typeface. Size and color of the text are employed to represent different blocks of information, as well as to distinguish the magazine from competitors.

Price, Date, and Barcode: These elements present additional information to readers. To make an interesting cover, designers usually do not focus on these elements. Some magazines carry these elements in an organized structure, whereas others may put them in a random place. Price should be presented in a place that is easy to find. The date also indicates whether or not the issue is current. Some magazines prefer the actual date for the publication’s date while others may prefer a sequential format to convey the longevity and prestige of the magazine. The barcode is probably the most challenging of these three elements, since the designer needs to deal with its white background. Some designers simply choose to leave it in a fixed place.

Spine: The spine makes available information related to the magazine, such as the logo (masthead), date, and sometimes a brief itemized list of its contents.

Back Cover: The back cover may be used to make the magazine look more appealing or valuable to the reader or may be sold to advertisers.

2. AUTOMATIC DESIGN

For designers, the main modules in the creation of a design are perhaps layout, design of color, and typography. In order to realize the idea of automatic design we have devised several methods to perform each module automatically. In this section, we discuss the system overview, layout and visual balance, typography and design of color.

2.1 System Overview

As Figure 2 shows, the system first takes a well-composed image as input. Here, we define a well-composed image as an image which obeys the *rule-of-thirds* [9]. This rule suggests that humans like to see important parts of an image to be placed on the two vertical and horizontal imaginary lines on the image. Another feature of a well-composed input image is to have the aspect ratio of 8.5in width to 11in height. This is a standard size for magazine covers. Given a well-composed image, the system makes decisions for layout of elements. In order to have an aesthetically appealing layout one needs to consider visual balance. In fact, visual balance is one of the most important elements in design [10]. In order to quantify visual balance, the system employs a visual saliency algorithm ([11] and [9]) to find important parts of the cover image. Here, important or salient parts are the most conspicuous regions of an image based on prediction of human eye fixations. In this fashion, the framework can designate a number of regions as candidates for inclusion of other elements of the cover, such as cover lines. Layout of text in such regions is part of typography. Our system performs the task of automatic text insertion in some geometric regions on the cover. This text insertion follows some rules and patterns recognized by analyzing the work of designers. A good design also includes simple and consistent pairs of colors. For instance, the color palette for texts – including masthead and cover lines – is usually a triple of colors.



Figure 2. Overview of the system.

2.2 Layout and Visual Saliency Considerations

Based on rules in Sec. 1.2 and lessons from professionals, we have derived a general template for magazine cover design illustrated in Figure 3. This template can vary, based on salient parts in the cover image and number of cover lines to maintain an aesthetically appealing visual balance.

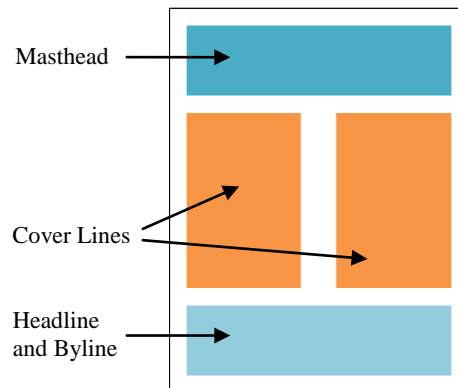


Figure 3. A general template for magazine covers. Note that cover line parts may vary according to the salient parts in the cover image.

Assuming an image follows the rule-of-thirds, our system applies the GBVS algorithm (Graph-Based Visual Saliency [11]) to it, and extracts a binary GBVS mask for it. Figure 4 illustrates the steps to obtain this binary mask for an image. White regions of a binary GBVS mask are important and black regions are considered as candidates for containing other elements of the cover, such as cover lines. Our intuition behind this approach is that if we divide an image into salient and non-salient parts, then we can position or overlay new elements on non-salient or empty regions; and the result conveys visual balance. Hence, we can compose a visually balanced layout.

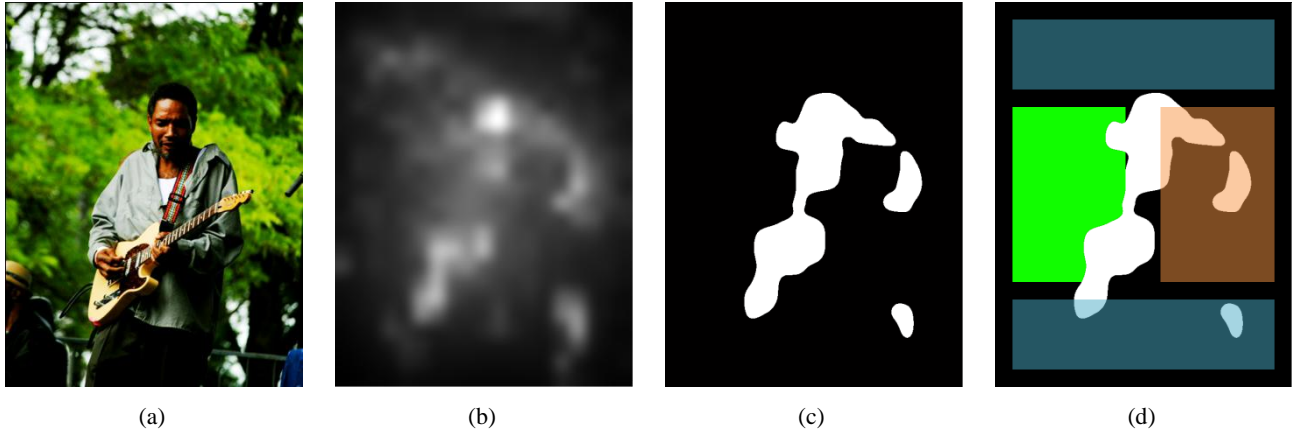


Figure 4. Finding salient and non-salient regions of cover image. a) An image. b) GBVS of (a). c) GBVS binary mask of (a). d) Fusion of general cover template (Figure 3) and GBVS binary mask (c).

As Figure 4.b shows, GBVS gives us a mask which contains values between 0 and 1. In order to obtain a binary mask shown in Figure 4.c, we threshold the GBVS mask. This threshold is dependent on the image. We use the Newton-Raphson method to obtain $1/9$ of the total area of the salient parts. We choose the fraction $1/9$ based on the intuition that if we consider the rule-of-thirds, then $1/9$ of an image is the most conspicuous or important part of it.

Having obtained the GBVS binary mask (Figure 4.c), if we apply the general cover template (Figure 3) to it, we obtain Figure 4.d. The green region in Figure 4.d is considered as a candidate for holding cover lines. The next step is to wrap the cover lines in this candidate region. This process is discussed in Sec. 2.3.

2.3 Typography

Typography is one of the main modules in design, in general, and in the design of magazine covers as a means of communication, in particular. Hence, where to put text including masthead, headline, byline, and other cover lines is an important decision that designers should make. The choice of typeface for masthead and other text is part of typography. The masthead is usually designed to be a logo for a magazine. Therefore, our system can take a logo or just a string of text for the masthead. The masthead has a fixed position: always on top and as large as possible. It has to make a magazine distinguishable among all the other competitors on a stand of magazines. Our system puts headline and byline at the bottom of the page. These texts should also be as large as possible, although smaller than the masthead. The byline should be smaller than headline to convey priority. The remaining of cover lines will be inserted somewhere between the masthead and the headline. Figure 3 illustrates these decisions.

Although we consider the orange regions in Figure 3 as places to put cover lines, we want to make the design more compelling and closer to the work of professionals. Looking to different magazine covers we have found a general pattern in how to make text indentation for cover lines. Indentations are usually in a form that imitate boundaries of the salient part(s) of the cover image. To illustrate this pattern, consider Figure 5.a (obtained in the same way described in Sec. 2.2) which contains a green region. The borders (red curve) of this region can determine how the indentation of cover lines in this region should look like. Therefore, our problem can be defined as following: how to insert text such that its indentation has the maximum fidelity to shape of green part and simultaneously its size is largest in an acceptable size range for cover lines (i.e. the largest possible size in the interval of [18, 36] points). We define this problem as an optimization problem where maximum fidelity to the shape of the green part and maximum size of the text is desired. We have devised an algorithm to solve this problem. Figure 5 (5.b and 5.c) illustrates results of our algorithm for this problem.

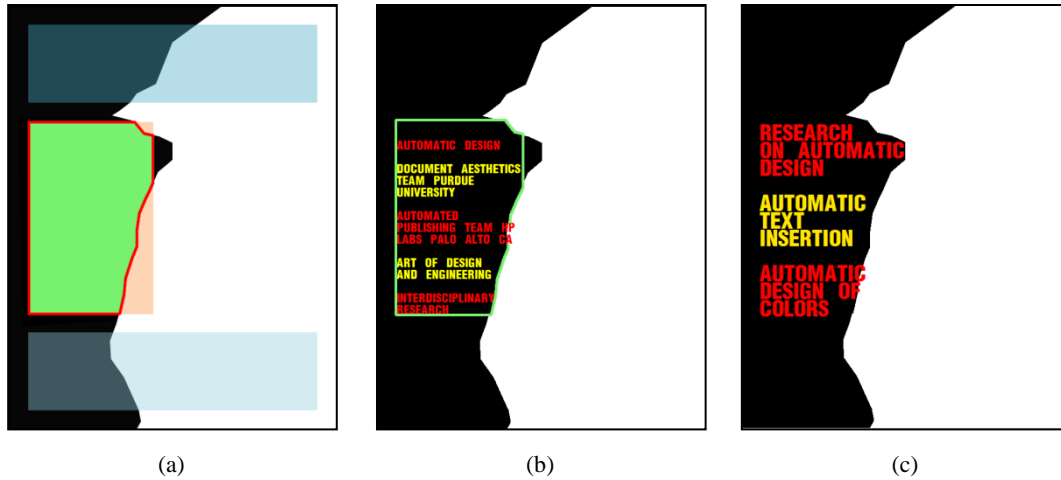


Figure 5. Layout of cover lines on magazine cover. a) The green region is a candidate to hold cover lines. We want to insert the text of the cover lines in a fashion that the text indentation follows the shape of the green region and the size of the text is as large as possible. b) Result of our automatic text insertion in the green region in (a). c) Another result of our automatic text insertion in the green region in (a). Note that the number of words and different words in the cover lines yield different results.

2.4 Design of Color

Design of a color palette – or which colors to choose to create a good design – is part of a designer’s work and concern. There are resources [12], [13], and [14] which suggest which colors go with which. In general, designers try to make a contrast between colors or make a linkage between colors. However, our problem is how to quantify these concepts. One of the most significant works in the area of quantifying aesthetics of colors is Itten’s color harmony concept [15]. Itten defines seven kinds of color contrast: contrast of hue, light-dark contrast, cold-warm contrast, complementary contrast, simultaneous contrast, contrast of saturation, and contrast of extension. Among these contrasts, complementary contrast is used in our work. Itten’s complementary contrast concept is based on physiological laws of afterimage and simultaneity. These laws suggest that our eyes are satisfied when they can perceive a balance in colors – or in Itten’s words “complemental colors”. Itten then defines a hue wheel as shown in Figure 6.a, which presents complementary colors in opposite directions. Our system applies the concept of complementary contrast to choose the color of the masthead. In order to work on the hue wheel of an image, the system changes the color space of the image from RGB to HSV. It then works on hue channel which is defined from 0 to 360 (degrees) where 0 corresponds to red. The system computes the histogram of the hue of the image, and finds the most repeated color in the image. It then finds the opposite to this color on the hue wheel, which is our choice for the masthead color.

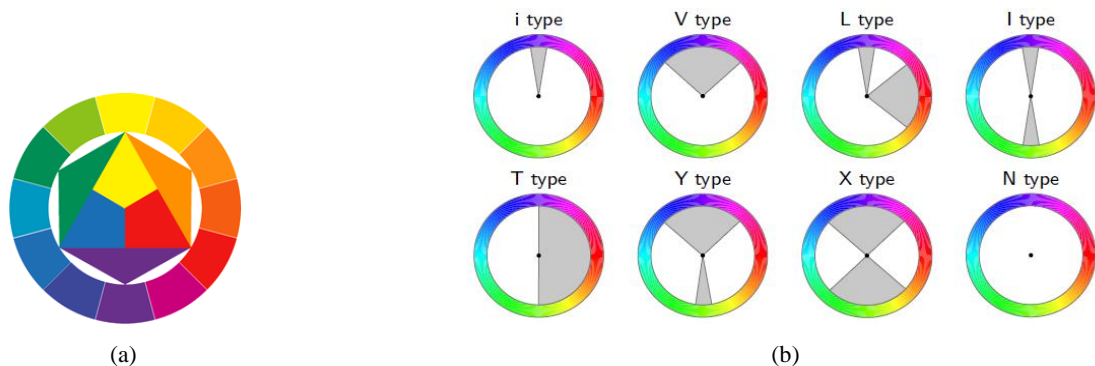


Figure 6. Elements of color design. a) Itten’s hue wheel. Note that complementary colors are in opposite directions: for instance, yellow and violet, or orange and blue. b) Matsuda’s harmonious templates. This figure is from [18]. Hues which are in shaded sectors are considered to be in harmony. The angles of the sectors are described in [17] and [18].

Having chosen a color for the masthead, now we want to find a set of colors for cover lines. For cover lines, we can use the idea of similar hues and same hues discussed in [19]. Some color resources call these ideas analogous colors [13] or light-dark contrast [16]. Similar hues are color hues which are adjacent colors on the hue wheel. Same hues are colors in the same hue but with different levels of shade [19], or more precisely, different values of S (saturation) and V (value) in HSV color space. A more comprehensive definition of these concepts is suggested by Mastuda’s harmonious templates. [17], [18]. Figure 6 illustrates seven different hue templates and a template for gray-scale images (N type). In each template, the hues that are in shaded sector(s) are considered to be harmonious.

3. EXPERIMENTAL RESULTS

In this section, we present some automatically designed magazine covers. From our preliminary discussions with professionals, the results illustrated in Figure 7 are acceptable and perhaps compelling to them. Figure 8 illustrates a screenshot of graphical user interface of our system. Our system does all the tasks automatically with just a click. It takes a few minutes for the system to accomplish the entire design. Our code is in Matlab and our experiments have been performed on a 64-bit PC machine with a 2-core 3GHz Intel processor and 4GB of RAM. This system will be implemented in Java as an internet service.



Figure 7. Some of the magazine covers automatically designed by our system. All aspects of the design are performed automatically.

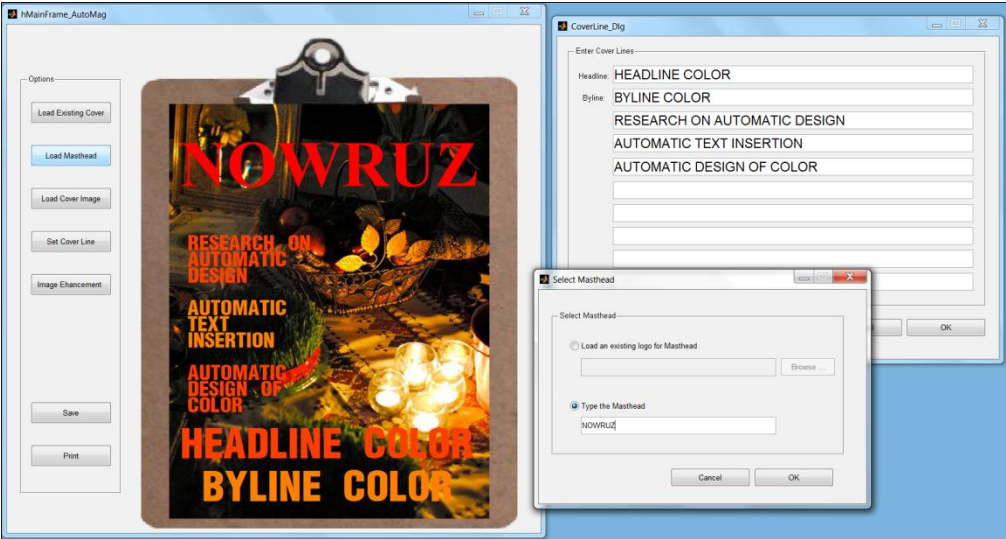


Figure 8. A screenshot of graphical user interface of our automatic magazine cover design system.

4. DISCUSSION AND FUTURE WORK

At this stage of our work, the feedback of professional designers suggests that our automatic designs are aligned with their intuition. However, there are some limitations in our system which deserve more investigation for quantifying aesthetics of design. A well-composed image as input to the system, for instance, is assumed in our research. At this stage of the work, we consider a well-composed image to be an image that is aligned with the rule-of-thirds. To be considered well-composed, an image should also satisfy criteria related to other features, such as content and color combination. These features need to be addressed in our future work. Our system also does not take care of different sizes of an input image. It assumes that the image is in the aspect ratio of the magazine cover to be designed. How to crop an image to obtain such an aspect ratio is another challenge under the umbrella of image resizing and image retargeting research. A further consideration is visual saliency. In some cases, Graph-based visual saliency (GBVS) does not satisfy our requirement for the salient part. We can instead use visual saliency to extract foreground from background. We also endeavor to quantify the idea of style in design. The style of a magazine, which is heavily influenced by the class of magazine, has a major influence on the design of magazine covers. We are interested in extending our model of color design to include the style of the magazine. We are also interested to determine what kind of typefaces can be used within the style of a magazine. Last but not least, we need to be able to score our designs. We have quantified a set of principles in design which help us to create compelling designs. However, having a set of design principles, one still needs the opinions of professionals to determine what is an ugly design or a good design. We will continue our interaction with professionals to refine our design algorithms and use measurements to score our automatic designs.

5. CONCLUSION

In this paper, we propose a system for automatic design of magazine covers that quantifies a number of concepts from art and aesthetics. We are interested to know how professional designers think during the process of magazine creation and how they create a cover, considering both form and functionality. If we can quantify and model this process, we can support non-designers to produce designs that are closer to the work of professionals. Accordingly, we have collaborated with professional designers, magazine art directors and editorial boards, and journalists to study the process of magazine cover design. We have then implemented what we have learned in the framework of a software tool. Our framework divides the task of design into three main modules: layout and visual balance considerations, design of color for masthead and cover lines, and typography of cover lines. At this stage of our work, the feedback of professional designers on our designs suggests that our results are congruent with their intuition. However, our future work includes further evaluation of our automatic designs by users.

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