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The application of CIE LAB to study trapping efficiency

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THE APPLICATION OF CIE LAB TO STUDY TRAPPING EFFICIENCY

by

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CERTIFICATE OF APPROVAL

MASTER'S THESIS

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with a major in Printing Technology has been approved by the Thesis Committee as satisfactory for the thesis requirement for the Master of Science degree at the convocation of February, 1988.

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ABSTRACT

It has been known that apparent trapping percentages caused by changing printing sequence (or printing order) affect the color appearance of the overprint areas. However, no other studies in the past were done in a standard color measurement system- that is the CIE system.

This thesis was conducted in order to learn how the selected printing sequences--yellow-magenta-cyan-black, black-cyan-magenta-yellow, yellow-magenta-cyan-black, and cyan-magenta-yellow-black-- of a monotack process ink yield the color gamuts on the CIE LAB color space. Since the two sequences: yellow-magenta-cyan-black and cyan-magenta-yellow-black, were recommended to be adopted as standard sequences for SWOP inks, this reseach attempted to prove that these sequences printed by a web-offset press yielded the similar color gamut on the CIE LAB color space. How the abovementioned selected printing sequences affected the changes in the apparent trapping percentages were also studied. The color differences between the color patches printed by changing printing orders and those of the ideal inks were calculated and compared with one another in order to find out whether the overprint colors visually differed from one another or not. Moreover, how the trapping changed the color appearance of the print from what was expected in terms of hue angles and chroma shifts were studied. Last but not least, the colorimetric trapping percentages were also studied.

It can be concluded from the findings that the changes of ink sequence of the monotack ink in the web-offset printing caused the wet-trapping percentages change. Thus caused the hue angle and chroma shifts which resulted in different color gamuts. It was

proved that the two sequences--yellow-magenta-cyan-black and cyan-magenta-yellow-black-- did not have the similar color gamut on the CIE LAB color space; they produced visually different green.

The relationships between ink trapping percentages and visually different color appearance in this study can be explained as follows. It is found that the trapping of yellow over magenta did not yield different color appearances from the trapping of magenta over yellow. The trapping of cyan over yellow yielded different color appearances from the trapping of yellow over cyan, but the trapping of cyan over magenta did not yield different color appearances from the trapping of magenta over cyan.

The densitometric apparent trapping percentages calculated from the Preucil's equation failed to explain the relationships between the red trapping and the color difference of the red printed patches from the red ideal ink. The colorimetric trapping percentages using the Preucil's concept was proved invalid.

Larger sample sizes and other ink sequences are recommended for the next study.

CHAPTER 1
INTRODUCTION

One of the major factors in determining a proper printing sequence (or printing order) is apparent ink trapping. The apparent trapping percentages of the inks in multicolor printing, affect the color appearance on the overprint areas. Although printers mostly work with halftone dots, each dot of each color does not trap exactly on each other when printed: some are printed on top of other dots while some are on the paper. The trapping percentages calculated from the solid ink densities of a color bar of a press sheet are good indicators for the final color cast.[1] The trapping percentages are very important for printers in order to calculate the degree of ink transfer onto a wet or a dry ink film which is first laid down on the print substrate. Different trapping percentages affect the change in the hue, saturation, and lightness of the overprints which can be measured by a colorimetric method.[2] Changing color sequences will cause changes in color and the inability to match the colors on jobs that printed with the same inks and paper, but with different ink sequences[3], because it introduces different trapping percentages for a particular process ink. Therefore, it is important to understand the background by which ink sequences are chosen to study ink trap.

Background of chosing the ink sequences to be studied

Theoretically, there are twenty-four ways to combine four process inks, and over half of these have been recommended on occasions for either letterpress printing or offset

lithography printing. The choice of color sequence can be influenced by the type and color-bias of the job and the press configuration, that is a single, two- or four-color press.[4] In the past, the popular sequence in letterpress printing was yellow (Y), magenta (M), cyan (C) and black (K). According to Terry Scarlet[5] the reasons for this were; firstly, the yellow was an opaque chrome yellow and secondly, it was the solution of the backtrapping problem caused by the thick films of letterpress ink. Backtrapping occurs when the printing plate picks up some of the previous printed ink from the paper and feeds it back into the roller train. If light colors are printed first, this effect will not be very noticeable because the light colors will be absorbed into the subsequent darker colors. Gravure and sheet-fed Offset Lithography tended to adopt this sequence until one found that laying yellow down first was not always suitable for offset printing. The reason was that:

"...yellow is usually the most prevalent color in a series of separations; red and blue are the most prevalent, with black the skeleton or key color. This means that by printing yellow first, most of the other colors would have to lay down over the wet yellow ink. Because of the thinner film of ink applied in offset printing , any tendency for poor trapping is much more obvious than it would have been with the thicker ink films printed by letterpress."[6]

Later, a newly developed yellow ink, transparent diarylides yellow, allowed printers to rotate any color they wanted. Thus, the sequence was chosen according to the printers' preferences. Gary G. Field wrote about this in the last major Graphic Arts Technical Foundation (GATF) color survey in 1972, a co-study of web offset printers with Ingram in 1976, and the Graphic Communications Association (GCA) Spectrum'82 research project. The results of these surveys are presented in Table 1.[7]

Table 1

Survey Results- Color Sequence Preferences in 1971, 1975, and 1982

Survey	GATF- All printers	GATF Web Offset	GATF Spectrum'82 Web Offset
Year	1971	1975	1982
Number of Samples	123	78	16
Sequences	KCMY 28	CMYK 40	KCMY 9
	YMCK 22	KCMY 13	CMYK 4
	YCMK 16	YMCK 11	YMCK 1
	Other* 57	Other 14	CKMY 1
			MKCY 1

*Fourteen sequences

From table1, it is shown that the preference of black-cyan-magenta-yellow (KCMY) in 1971 changed to cyan-magenta-yellow-black (CMYK) in 1975, and again to black-cyan-magenta-yellow (KCMY) in 1982. In 1984, Gary Field conducted the so-called "The Color Sequence in Four-Color Printing" research. He used a perfect trapping condition and recommended that the two sequences: yellow-magenta-cyan-black (YMCK) and cyan-magenta-yellow-black (CMYK), should be adopted as standard sequences for SWOP inks.[8] Recently, a 1986 survey on ink sequences illustrates that the two sequences are popular, as is shown in the Table 2.[9]

Table 2

A 1986 Ink Sequence Survey

Printing Segments	Sequence	
	YMCK	CMYK
Sheet-fed Offset		
Proofing	25%	62%
Production	6%	84%
Web Offset		
Commercial	-	100%
Publication	3%	97%

Table 2 shows that the two major sequences, YMCK and CMYK, are used in both web-fed and sheet-fed offset printing. The YMCK sequence is less popular in commercial web offset although it was recommended by Gary Field to be one of the standard ink sequences. The sequence CMYK which is adopted in commercial web offset, however, has not yet been approved as a standard for SWOP. Furthermore other printers use other sequences. According to Mr. William Eisner,[10] the director of research and development of the Technical and Education Center of Rochester Institute of Technology, the sequence that he selected for his web-offset press is KCMY. This choice of ink sequence in web offset leads to the following question: "How do the two sequences which are equally usable by a laboratory testing- YMCK and CMYK, affect the color gamut of a process ink used in a real printing condition?" Moreover,the color gamut that each particular ink sequence produces has not been studied in a psychometric way. The psychometric terms used are defined by R. W. G. Hunt. He stated that Psychometric terms are

"terms denoting objective measures of physical variables that are evaluated so as to relate to the magnitude of important attributes of light and color and such that equal scale

intervals represent approximately equal perceived differences in the atttribute considered. These measures identify pairs of stimuli that produce equally perceptible differences in response in a visual process in specified viewing conditions."[11]

The ink sequences mentioned above lead to the choice for the most frequently used ink sequences to study ink trap according to the historical background. They are YMCK, KCMY, YMCK and CMYK. These sequences introduce different percentages of apparent trapping, which are the total results of optical characteristics of ink layers. If the apparent trapping is a phenomenon that cannot be avoided, it is interesting to study how the trapping changes the color appearance of the print from what was expected, and how the color gamut of each changing ink sequence differs from that of the ideal ink in order to predict the color cast of the final reproduction. Moreover, it has been known that the colorimetric method is more important than the densitometric method in measuring color. The question is that: "Can the colorimetric method be used to find the valid percent trapping as well as the densitometric method?"

These questions lead to the following statement of the problem:

Statement of the problem:

1. What is the color gamut of a process ink on a CIE LAB color space produced by each selected ink sequence?
2. What are the color differences between the colors printed by each ink sequence and those of the ideal inks?
3. What are the effect of apparent trapping percentages of each ink sequence to the shifting of color appearance in a CIE LAB color space?
4. What are the densitometric trapping percentages of different color sequences ?
5. How can colorimetric trapping percentages be calcualated?

Objectives:

1. To find the gamut on a CIE LAB color space of each color printed by changing the ink sequences.
2. To find the color differences between the colors printed by changing ink sequences and those of the ideal inks.
3. To find the hue and chroma differences of the overprinted colors from the expected values of each selected ink sequence.
4. To find the densitometric apparent trapping percentages of each printing sequence under study.
5. To find the colorimetric apparent trapping percentages of each printing sequence under study.

Limitations:

1. This study focussed on one widely used monotack process ink.
2. The ink sequences under study were: YMCK; YCMK; CMYK; and KCMY.
3. This study dealt with the wet-trap resulted from the web offset printing.

Hypotheses:

1. Each of the four different ink sequences will yield different color gamuts on a CIE LAB color space.
2. The YMCK and CMYK sequence will have similar color gamuts.
3. The ink sequence which yields the highest color differences from the colors of the ideal inks will have the lowest Preucil's ink trapping percentages among each laid-down color.

FOOTNOTES FOR CHAPTER 1

1. Leslie A. Watkins, "Trap Percentage in Four-Colour Printing", Monthly Bulletin of the Research Institute for Newspaper Development vol.5, no.2 (February, 1984), p.2.

2. George W. Jorgensen, "Control of Color on Press: Overprints", GATF Research Project, no. 118 (Pittsburgh: GATF,1983), p.1.

3. Michael Bruno, Principles of Color Proofing (Salem: GAMA Communications, 1986), p. 82.

4. "Standardising Process Colour Printing", British Printing Industries Federation (London: British Printing Industries Federation,1983), p.8.

5. Terry Scarlet,"The Controversy of Color Sequence", Graphic Arts Monthly vol. 52, no. 7 (July 1979), pp.140-4.

6. Ibid.

7. Gary G. Field,"Color Sequence in Four-Color Printing", TAGA Proceedings (1984), p. 511.

8. Ibid., p.516.

9. Michael Bruno,"What 's (New)s in Graphic Communications.", Special Report in Status of Printing in the USA (1986), p. 13.

10. William Eisner, Interviewed by Author (August 2, 1987.)

11. R. W. G. Hunt, "The Specification of Colour Appearance I Con-cept and Terms", Color Research and Application vol.2, no.2 (Summer 1977), p. 57.

CHAPTER 2

LITERATURE REVIEW OF THE STUDY OF INK TRAP

According to George W. Jorgensen (1982) ink trap can be defined as follows:

"Ink trap is the lift or transfer of ink from the printing element onto the surface of a substrate. The substrate may be absorbent, such as paper, or non-absorbent, such as metal or plastic. In addition, the substrate surface may already be covered, partially or totally, with wet or dry ink film."[1]

The term wet-trap is used when the first down ink film is wet before being overprinted by the second ink and, similarly, the term dry-trap is refered to a study in which the first down ink film is dry.[2] Jorgensen explained the measurable definition of ink trap as follows:

"Ink trap in single color printing is expressed as the ratio of the film thickness transferred on the substrate relative to the ink film thickness on the printing element before impression. In multi-color printing, ink trap is expressed as the percentage of ink film thickness on overprint areas relative to the same ink film thickness printed directly to the substrate."[3]

Therefore the trapping equation would be

$$\text{Trapping percentage} = \frac{\text{ink film thickness of ink on ink}}{\text{ink film thickness of ink on paper}} * 100$$

This definition helps to explain the concept of the Frank Preucil's ink trapping equation which stated that:

$$\%\ \text{trap} = (D_{1+2} - D_1)/D_2 * 100$$

which D_1 is the density of the first-down ink directly on the paper, D_2 is the density of the second-down ink directly on paper, and D_{1+2} is the density of the overprint of the second-down on the first-down ink. The filters that are being used to measure trap must be complementary to the overprint colors. For example, for the CMYK sequence; this reads as follows:

% yellow over magenta trap = Dred-Dmagenta/ Dyellow*100 (all densities are read through a cyan filter);

% magenta over cyan trap = Dblue-Dcyan/ Dmagenta*100 (all densitities are read through a yellow filter); and

% yellow over cyan trap = Dgreen-Dyellow/ Dcyan*100 (all densities are read through a magenta filter).

To explain that the Preucil's equation corresponds to the ink trap definition, let D_2' equal the density of the second-down ink on the first ink layer. This equation assumes that D_{1+2} equals D_1+D_2'. Therefore the formula should be

$$\%\ \text{trap} = D_2'/D_2 * 100 .$$

Preucil called his method "apparent trap equation"[4] because the way the ink film thickness has been measured by using a reflection densitometer does not accurately measure a physical trap. He, therefore, was interested in the total effect of the optical densities of the two ink film layers.[5] The effect of ink trap is hidden in the addivity failure which means that the filtered density of a combination of inks is not equal to the sum of the densities of the individual inks measured through the same filter.[6] To illustrate, Zenon Elyjiw stated that

"...the proportion of ink film thickness to density is one of the basic rules of densitometry, but, it applies only to transmission densities. In reflection densitometry,

there is some maximum density that can be reached. Beyond that it cannot be increased regardless of how thick a layer of ink is added." [7]

According to Yule and Clapper[8], the total effect which may be called "apparent trap" is the result of a number of conditions:

1. First surface reflections. Matte surface papers and inks will cause light scattering from the surface of ink films and their overlaps. The overlaps will have a higher gloss and consequently will exhibit less light scattering than the individual ink films. This means that the densities of the overlaps will be greater than each of the individual layers.

2. Multiple internal reflections. Some light rays, upon entering an ink film, will reflect back and forth between the paper surface and the surface of the ink film. It contributes to higher density measurements. For the thick ink films (overlaps), the factor is less important than for the thin ink films. The overlaps will have a lower density than would be expected from the sum of the individual ink films.

3. Opacity. The refractive indices of the pigments and vehicles in printing inks are not identical, the printed ink films will exhibit varying degrees of opacity. Therefore, the overprint color tends to be dominated by the second down ink color.

4. Ink trap. If a different ink film thickness is transferred to a previously printed ink as compared to the unprinted substrate, the result is under or over trapping. The sum of the ink film thickness of the individual inks will not equal the overprint ink film thickness.

5. Back Transfer Effects. In wet-trap, it is possible for the second down ink to remove some of the first down ink. It thus reduces the thickness of the first down ink, and consequently also reduces the thickness of the first down ink in the overprint area. The second down ink will also be contaminated with the first down ink.

6. Spectral characteristics. The spectral response of the densitometer (especially the filter selection) will influence the additivity of the densities.

There are two more ink trap formulae. The first one has been suggested by Brunner[9] It reads as follows:

$$\% \text{ trap} = 1\text{-}10^{-DS1+2}/1\text{-}10^{-(DS1+DS2)}*100$$

The second one has been suggested by Childers.[10] It reads as follows:

$$\% \text{ trap} = 10^{(DS1+2-D2-D1)}*100$$

In these formulae D_{S1} is the density of the first-down ink directly on the paper, D_{S2} is the density of the second-down ink directly on paper, and D_{S1+2} is the density of the overprint of the second-down on the first-down ink.

Zenon Elyjiw stated in 1981 that the preucil's equation was considered valid because it calculates the whole range of possible trapping from 0% to 100%, and beyond that in case of overtrapping.[11] These three densitometric ink trap formulae have been evaluated in laboratory experiment by Gary G. Field[12] in 1985. He found that the Preucil's equation was better than the others because it responded in a linear manner to changes in ink film thickness while the Childers's and Brunner's formulae did not predict the magnitude of the change quite well. Furthermore, he stated that the Childers's equation seriously overestimated overtrapping and undertrapping, while the Brunner's equation seriously underestimated undertrapping.

George Jorgensen[13]also suggested that apart from the densitometric method, the spectrophotometric and the colorimetric method could also be used. He claimed that the application of the spectrophotometer to ink trap measurement was very similar to that of the densitometer. Its primary advantage is that it can measure monochromatically at single wavelengths, across the reflectance spectra of the print. For the colorimetric method, he argued that it would be a possibility to derive ink trap measurements from colorimetric values. It would require some mathematical treatment of the data which have not yet been

found in the literature. However, the additivity failure would still apply to both the spectrophotometric and the colorimetric method.

The trapping has been studied because any change in ink trap affects the color balance in multi-color printing. Unlike in single color printing, in which only the ink film thickness can be monitored and only the color saturation and lightness of the ink are of interest, in multi-color printing the hue, the third dimension of color, is also an important control factor.[14] Therefore, when the ink trap changes, the hue, saturation, and lightness of the overprint change accordingly. Terry Scarlet supported that the trap or lay down of one color over another is very important to produce a good secondary color.[15] The abovementioned statements have been confirmed in 1976 by the study of Francis L. Cox, entitled "A Method for Establishing the Optimum Color Balance in the Trichromatic System of Color Reproduction". He found that the trapping differences caused by rotation of two ink sequences-YMCK and CMYK, change the trichromatic balance of a proof press from that of a production press.[16]

In 1984, Gary G. Field [17] studied the color sequence in four-color printing by using a dry-trap laboratory experiment and SWOP inks. He printed solid ink patches of four sequences-KCMY, YMCK, CMYK and YCKM by achieving perfect trapping. He evaluated the four-color solids of the paper prints by using the densitometric method and plotted the values on the GATF color hexagon. He recommended that the follows two sequences-YMCK and CMYK should be chosen as the standard sequences for the publication industry because they can produce similar hue and saturation.

From the literature cited, it can be concluded that not only the ink sequence variable but also the ink trapping varible affects the color appearance of the prints. In printing condition, ink sequence and trapping caused by changing the sequence, will reinforce the shifts of the prints' color appearance.

Related research done in this field

1) In 1971, Michael Austin[18] studied the color gamut of five ink sets on U*, V*, and W*color space and found the importance of a given difference in the gamut by calculating the panel ranking results for the pleasing appearance of each ink set.

2) In 1980, John T. Chittick[19] investigated the effects of screen frequency upon pastel color saturation. He made single and two color overprint tints of 5, 10, and 15 percent printing dot areas with different screen rulings. Then, he measured the reflectances of these colors with a colorimeter and converted them to CIE L*a*b* color notation. He concluded that the pastel saturation increased when the screen ruling became finer (with constant physical dot area), and lightness decreased whenever saturation increased.

FOOTNOTES FOR CHAPTER 2

1. George W. Jorgensen, "Review of Ink Trap Studies", GATF Annual Research Department Report (Pittsburgh: GATF, March 1982), p.47.

2. Gary G. Field, "Ink Trap Measurement", TAGA Proceedings (1985), p. 383.

3. George W. Jorgensen, Op.cit.

4. Gary G. Field, Op.cit., p.392.

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6. Gary G. Field, Op. cit., p.383.

7. Zenon Elyjiw, "More on Ink Trap...Was the Original Equation Right?", Graphic Arts Monthly vol.53, no.9 (September,1981), p.34.

8. J. A. C. Yule and F. R. Clapper, "Additivity of Ink Densities in Multicolor Halftone Printing", TAGA Proceedings (1956), pp.157-162.

9. Du Pont, Cromalin Offset Com Guide/System Brunner (Wilmington: E.I. du Pont de Nemours, 1984), p. 22.

10. Warren Childers, "Expert Shows Math Path to Avoid Ink Trap Trap", Graphic Arts Monthly vol. 52, no. 12 (December 1980), pp.63-64.

11. Zenon Elyjiw, Op.cit., p.38.

12. Gary G. Field, Op.cit., pp. 395-396.

13. George W. Jorgensen, Op.cit., p. 52.

14. George W. Jorgensen, "Control of Color on Press: Overprint", GATF Research Paper no. 118,1983, pp. 1-4.

15. Terry Scarlet, "The Controversy of Color Sequence", Graphic Arts Monthly vol.52, no. 7 (July 1979), p.140.

16. Francis L. Cox, "A Method for Establishing the Optimum Color Balance in the Trichromatic System of Color Reproduction", TAGA Proceedings (1976), pp.32-42.

17. Gary G. Field, "Color Sequence in Four-Color Printing", TAGA Proceedings (1984), pp. 519-520.

18. Michael Austin, " The Relationship Between Colors in an Original, the Reproduction Process, and the Color Gamut of Process Ink Sets", Inter-Society Color Council Proceedings (1971), pp.191-192.

19. John T. Chittick, "The Effect of Screen Ruling on the Saturation of Pastel Gamut Colors", Master's Degree Thesis (New York: School of Printing R.I.T., 1980), p.1.

CHAPTER 3

THEORY

It has been found that the densitometric system is not appropriate for measuring colors. The percent hue error and grayness which require filtered densities were discussed by John Yule[1] in 1967. He stated that there was a danger if they were used as a color measurement system because the spectral sensitivities of the measuring instrument were not related to the sensitivity of the eye. Nor does it correspond to the sensitivity of the photographic film. He, therefore, stated that "since standard color measurement systems already exist, it is undesirable to add another system."[2]

The standard color measurement system that he advocated will be discussed in detail. It starts from the premise that colors of all surfaces can be ordered in a three-dimensional space, i.e. the dimensions of lightness, hue, and saturation.[3] A color order system based on these three appearances is called a color appearance system.[4]

In 1905, A. H. Munsell proposed the use of a color appearance system which is known to-day as the Munsell system.[5] Instead of lightness the term value was used, and chroma instead of saturation. This system is useful for the graphic arts. John Yule suggested that the use of the Munsell value coordinates for the tone reproduction study proved to be better than the density coordinates because it provided a visual uniformity from light to dark where the density did not.[6] The Munsell value can be converted into the density value by the following equation[7]:

$$Y = 1.2219V - 0.2311V^2 + 0.2395V^3 - 0.021009V^4 + 0.0008404V^5$$

$$D = -\log(Y/102.56)$$

where Y is reflectance, V is the Munsell Value, and D is the density.

While the Munsell system is the result of collections of physical samples, the color-order system that was developed to be used in connection with color measurement instruments is the CIE system of the Commission International de l'Eclairage or the International Commission on Illumination.[8]

The CIE and the CIE LAB color space

CIE first set a standard color-order system called the CIE chromaticity diagram in 1931. The objective was to describe the qualities of a color with its chromaticity coordinates x, y, and z. The x, y, and z are the ratios of the imaginary tristimulus values X,Y,Z to their sum, X+Y+Z.[9] The X, Y, and Z are mathematically transformed from the amount of monochromatic primary stimuli at wavelength 700.0, 546.4, and 435.8 nanometer required by a person with normal color vision to match any of the spectrum color, provided each of the spectrum light sources emits the same amount of power.[10] The diagram is the horseshoe-shaped spectrum locus which can be used to tell whether two colors match. (Two colors will only match if they have the same tristimulus values.) Unfortunately, as Mc Laren stated, the disadvantage of the CIE system is that it is not equally visually spaced:

"The CIE system of colorimetry has been in existence for fifty years as a means of specifying color stimuli and predicting metameric matches. However, it has been known right from the time of its adoption, that the system does not provide a direct way to predict whether two slightly different color stimuli can be discriminated by the human eye. The distance in CIE tristimulus (X,Y,Z) space or in the CIE chromaticity (x,y) diagram, between two colors that are just noticeably different from each other is very far from being constant."[11]

Therefore, there was a great need to modify the CIE system to a uniform color space. The officially recommended modification known as the 1976 CIE L* a* b* space, which in 1978 received the official abbreviation CIE LAB , attempts to transform the CIE tristimulus values X, Y, and Z to the three quantities L*, a*, and b*.[12] The CIE LAB's idea concurs with the opponent-color coordinates which stated that somewhere between the eye and the brain, signals from the cone receptors in the eye get coded into light-dark, red-green, and yellow-blue signals.[13] Thus, the redness or greeness can be expressed as a coordinate a*, which is positive if the color is red and negative if it is green. Similarly, the yellowness or blueness is expressed by a coordinate b*, which is positive for yellow and negative for blue. The third coordinate describes the lightness of the color, and is usually called L*. The importance of the CIE LAB is that equal distances between colors in any parts of the CIE LAB color space represent approximately equal perceptual differences which are useful to determine color differences numerically.[14] The L* a* b* values are calculated from these equations:[15]

$$L^* = 116\,(Y/Y_0)^{1/3}-16$$

$$a^* = 500[(X/X_0)^{1/3}-(Y/Y_0)^{1/3}]$$

$$b^* = 200[(Y/Y_0)^{1/3}-(Z/Z_0)^{1/3}]$$

X_0, Y_0 and Z_0 are tristimulus values of a perfect diffuser of the illuminant used. The CIE LAB is recommended for daylight illumination (D65). Thus, $X_0 = 95.018$, $Y_0 = 100.00$ and $Z_0 = 108.845$. The L*a*b* co-ordinates are cartesian ones but they can be converted into the cylindrical coordinates $L^*C_{ab}^*\ h_{ab}$ (lightness, chroma, hue angle) by these equations:[16]

$$C_{ab}^* = [(a^*)^2+(b^*)^2]^{1/2}$$

$$h_{ab} = \arctan b^*/a^*$$

The color difference between sample and standard will be calculated from the equation $\Delta E_{ab} = [(\Delta a^*)^2+(\Delta b^*)^2+(\Delta L^*)^2]^{1/2}$. ΔE_{ab}, or the total perceived color difference,

comprises the perceived lightness difference (ΔL^*), the perceived chroma difference (ΔC^*ab) and the perceived hue difference (ΔH^*_{ab}) from the equation ΔE_{ab}= $[(\Delta H_{ab})^2+(\Delta L^*)^2 + (\Delta C_{ab}{}^*)^2$.[17] The relationship between the Munsell system and the CIE system is as follows:

$V = Y^{1/2}$ (Y is the CIE Y value)

(V is the Munsell value)

$Y = Yn\ [(L^* +16)^3/(116)^3]$

FOOTNOTES FOR CHAPTER 3

1. J. A. C. Yule, Principles of Color Reproduction (New York: John Wiley & Sons, 1967), p.161.

2. Ibid., pp.165-166.

3. Michael Bruno, "Color and Light", Graphic Arts Manual (New York: Musarts Publishing, 1980), p.22.

4. Ibid.

5. Ibid., p. 23.

6. J. A. C. Yule, Op.Cit., p.118.

7. Michael Bruno, Op.Cit., p.25.

8. Fred W. Billmeyer, Jr. and Max Saltzman, Principles of Color Technology(2nd. edition) (New York: John Wiley & Sons, 1981), p.34.

9. Ibid., p.47.

10. Deane B. Judd and Gunter Wyszecki, Color in Business, Science and Industry (New York: John Wiley & Sons, 1975), pp.59-63.

11. K. McLaren, The Colour Science of Dyes and Pigments (Bristol: Adam Hilger, 1983), p.121.

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13. Ibid.

14. George A. Agoston, Color Theory and Its Application in Art and Design (Berlin: Springer-Verlag, 1979), p. 83.

15. Fred W. Billmeyer and Max Saltzman, Op.Cit., p. 63.

16. Deane B. Judd and Gunter Wyszecki, Op.Cit., p. 320.

17. SAEJ1545, "Recommended Practice, Instrumental Color Difference Measurement for Exterior Finishes, Textiles and Colored Trim.", p.3.

18. Fred W. Billmeyer and Max Saltzman, Op.Cit., pp. 62-63.

CHAPTER 4

RESEARCH METHODOLOGY

1. Independent Variables

1.1. The ink sequence

The ink sequence means the order in which the process ink will be printed consecutively in the four-color printing process. The sequences under study are YMCK, YCMK, CMYK, and KCMY.

1.2. The apparent ink trapping percentage

The apparent ink trapping means the ratio of the acceptance of a new ink film by the previous layer to that by the paper. The percentage of ink trapping will be calculated by using the Preucil's equation.

2. Dependent Variables

2.1. Color gamut

The color gamut means the boundary of the color on the CIE LAB color space which each ink sequence can produce.

2.2. Color appearance of the CIE LAB system

The color appearance is the lightness-darkness, redness-greenness, and blueness-yellowness of a color.

2.3. Color differences

The color differences are the differences of the color appearances between standards and samples. They can be divided into perceived lightness differences, perceived chroma

differences, and perceived hue differences. The standard color appearances are calculated from the L*, a*, and b* values of the ideal red, green, blue, yellow, magenta and cyan ink.

3. Materials

3.1. Four positive films of solid patches.

3.2. Four color separation films (high key, low key, normal key and flesh tone)

3.3. Four Kodak Polymatic positive plates .(size 17 1/2 * 21 1/2 in.^{2})

3.4. A set of G.P.I. monotack process inks.

3.5. Three rolls of Mead coated paper 80 lb (35-inches width.)

3.6. Three plies of W.R. Grace Polyweb compressible blankets.

3.7. Ross fountain solution no.5.

3.8. Graph papers.

4. Equipment

4.1. A Gretag D186 densitometer for process control,

4.2. A MacBeth TR 927 densitometer for filtered density measurement,

4.3. A Thwing-Albert Inkometer,

4.4. A Hunterlab Labscan LS 5100 spectrocolorimeter,

4.5. A Macintosh Plus personal computer and a Jazz spreadsheet program,

4.7. A Harris Graphic M-1000 web offset printing machine (four units).

5. Experimental Procedures

5.1. The four positive flats were exposed to the four positive plates.

5.2. The first sequence:KCMY, was printed by operating the web-offset machine. By using the printers' eye ball the density of cyan, magenta, and yellow was

adjusted until the three-color overprints achieved a neutral gray. The numbers of the printing sheets were 2,000.

5.3. The reflection density of each color was measured by the Gretag densitometer. The recorded densities for the first sequence were black = 1.60, cyan = 1.20, magenta = 1.15, and yellow = 1.00.

5.4. Other sequences for 2,000 sheets each were printed and the densities to the recorded densities in 5.3 with the tolerance between +.07 and -.07, were adjusted.

The printing conditions for printing the four sequences are as follows:

5.4.1. The packing of all plates was .001" above bearers.

5.4.2. The packing of all blankets was .005" above bearers.

5.4.3. The printing speed was 1,000 feet/minute.

5.3.4. The conductivity of the fountain solution was 2,600; the pH was 3.9.

5.3.5. The web dryer temperature was 255°F.

5.5. The 30 samples were selected from the 2,000 sheets of each sequence by picking one sample out of every 50 sheets.

5.6. The red filtered, green filtered, blue filtered, and visual filtered densities of the color patches on every sample were measured by using the MacBeth TR 927.

5.7. The L*, a*, and b* values of each color patches of each sample were measured by using the Hunterlab spectrocolorimeter.

5.8. The ink tack was measured by using the Twing-Albert inkometer at 1,200 round per minute and the 90°F temperature.

6. <u>Data Analyses</u>

6.1. The L* a* b* values of ideal cyan, magenta, yellow, red, green, and blue inks were calculated as follows:

6.1.1. By using the Jazz spreadsheet program, the X,Y,Z values of each ideal ink were calculated from the following equation:

$X = k \int S*O*x$ or $X = k \sum S*O*x$

$Y = k \int S*O*y$ or $Y = k \sum S*O*y$

$Z = k \int S*O*z$ or $Z = k \sum S*O*z$

$k = 100/S*y$

S = the spectral power distribution of CIE Standard Illuminant D65.

O = the spectral transmittance or reflectance of the object which is either 1 or 0 for the ideal inks.

x, y, z = 10 standard observer color matching functions (1964 CIE)

6.1.2. After obtaining the X,Y,Z values, the L* a* b* of each ink were calculated by the following equation:

$L* = 116(Y/Y_0)^{1/3}-16$

$a* = 500[(X/X_0)^{1/3}-(Y/Y_0)^{1/3}]$

$b* = 200[(Y/Y_0)^{1/3}-(Z/Z_0)^{1/3}]$

6.2. The mean and standard deviation of the L* a* b* values of cyan, magenta, yellow, red, green, and blue patches were calculated from the 30 samples of the four ink sequences.

$\text{Mean} = \sum x/n$

$\text{S.D.} = (\sum (x-x)^2/n-1)^{1/2}$

6.3. The color difference values between the L* a* b* values of cyan, magenta, yellow, red, green, and blue of the ideal inks and those of the practical inks were calculated. The color difference equation is as follows:

$\Delta Eab = [(\Delta a*)^2+(\Delta b*)^2+(\Delta L*)^2]^{1/2}$

6.4. The mean and standard deviation of the red filtered, green filtered, blue filtered, and visual filtered densities (subtracted out the paper densities) of the cyan,

magenta, yellow, red, green, and blue patches of the 30 samples of the four ink sequences were calculated. The formulae are as stated in 6.2.

6.5. The densitometric trapping percentages from the average filtered density of red, green, and blue colors from the four different ink sequences were calculated.

% trapping of Y over M = (Rdensity-Mdensity/Ydensity) *100

(the densities were read through a blue filter)

% trapping of M over Y = (Rdensity-Ydensity/Mdensity) *100

(the densities were read through a green filter)

% trapping of Y over C = (Gdensity-Mdensity/Ydensity) *100

(the densities were read through a blue filter)

% trapping of C over Y = (Gdensity-Ydensity/Cdensity) *100

(the densities were read through a red filter)

% trapping of M over C = (Bdensity-Cdensity/Mdensity) *100

(the densities were read through a green filter)

% trapping of C over M = (Bdensity-Mdensity/Cdensity) *100

(the densities were read through a red filter)

6.6. The expected average L* a* b* values of the red, green, blue patches, produced from each ink sequence, were calculated by the following procedure:

6.6.1. The expected average L* a* b* values of the red patch were calculated.

6.6.1.1. The reflectance of the red patch from each sequence were calculated.

Since D of R(expected) = $D(Y+M)_r + D(Y+M)_g + D(Y+M)_b$

R of R_r(expected) = -antilog $D(Y+M)_r$

R of R_g(expected) = -antilog $D(Y+M)_g$

R of R_b(expected) = -antilog $D(Y+M)_b$

D of R(expected) = the total density of the red patch

$D(Y+M)_r$ = the red filtered density of the yellow patch + the red filtered density of the magenta patch

$D(Y+M)_g$ = the green filtered density of the yellow patch + the green filtered density of the magenta patch

$D(Y+M)_b$ = the blue filtered density of the yellow patch + the blue filtered density of the magenta patch

R of R_r(expected) = the expected reflectance of the red patch in the red region of the spectrum

R of R_g(expected) = the expected reflectance of the red patch in the green region of the spectrum

R ofR_b(expected) = the expected reflectance of the red patch in the red region of the spectrum

6.6.1.2. The X, Y, Z values from R of R_r, R of R_g, and R of R_b were calculated by using the spreadsheet program as stated in 6.1.1

6.6.1.3. The L* a* b* values of the expected red were calculated by using the spreadsheet program as stated in 6.1.2

6.6.2. The expected average L* a* b* values of the green patch were calculated.

6.6.2.1. The reflectance of the green patch from each sequence was calculated.

Since D of G(expected) = $D(C+Y)_r + D(C+Y)_g + D(C+Y)_b$

G_r(expected) = -antilog $D(C+Y)_r$

G_g(expected) = -antilog $D(C+Y)_g$

G_b(expected) = -antilog $D(C+Y)_b$

D of G(expected) = the total density of the green patch

$D(C+Y)_r$ = the red filtered density of the cyan patch + the red filtered density of the yellow patch

$D(C+Y)_g$ = the green filtered density of the cyan patch + the green filtered density of the yellow patch

$D(C+Y)_b$ = the blue filtered density of the cyan patch + the blue filtered density of the yellow patch

R of G_r(expected) = the expected reflectance of the green patch in the red region of the spectrum

R of G_g(expected) = the expected reflectance of the green patch in the green region of the spectrum

R of G_b(expected) = the expected reflectance of the green patch in the red region of the spectrum

6.6.2.2. Calculated the X, Y, Z values from R of G_r, R of G_g, and R of G_b by using the spreadsheet program as stated in 6.1.1

6.6.2.3. Calculate L*a*b* values of the expected green by using the spreadsheet program as stated in 6.1.2

6.6.3. Calculated the expected average L*a*b* values of the blue patch

6.6.3.1. Calculated the reflectance of the blue patch from each sequence.

Since D of B(expected) = $D(C+M)_r$ + $D(C+M)_g$ +$D(C+M)_b$

R of B_r(expected) = -antilog $D(C+M)_r$

R of B_g(expected) = -antilog $D(C+M)_g$

R of B_b(expected) = -antilog $D(C+M)_b$

D of B(expected) = the total density of the green patch

$D(C+M)_r$ = the red filtered density of the cyan patch + the red filtered density of the magenta patch

$D(C+M)_g$ = the green filtered density of the cyan patch + the green filtered density of the magenta patch

$D(C+M)_b$ = the blue filtered density of the cyan patch + the blue filtered density of the magenta patch

R of B_r(expected) = the expected reflectance of the blue patch in the red region of the spectrum

R of B_g(expected) = the expected reflectance of the blue patch in the green region of the spectrum

R of B_b(expected) = the expected reflectance of the blue patch in the red region of the spectrum

6.6.2.2. The X, Y, Z values from R of B_r, R of B_g, and R of B_b were calculated by using the spreadsheet program as stated in 6.1.1

6.6.2.3. The L* a* b* values of the expected blue were calculated by using the spreadsheet program as stated in 6.1.2

6.7. The ΔC_{ab} and ΔH_{ab} between the average measured L* a* b* values and those of the expected values calculated from 6.6 for the red, green, and blue patches of each sequence were calculated.

$$C_{ab}^* = [(a^*)^2+(b^*)^2]^{1/2}$$

$$\Delta C_{ab}^* = C_{ab}^*(\text{measured}) - C_{ab}^*(\text{expected})$$

$$\Delta H_{ab} = [(\Delta E_{ab})^2 - (\Delta L^*)^2 - (\Delta Cab^*)^2]^{1/2}$$

6.8. The trapping percentages from the average measured L* value of the red, green, and blue patches of the four sequences were calculated. The procedures were as the followings:

6.8.1. The L* values to the CIE Y values were transformed by this equation: $Y = 100[(L^*+16)^3/(116)^3]$

6.8.2. The CIE Y values to the Munsell value(V) were transformed by this equation: $V = Y^{1/2}$

6.8.3. The reflectance values from the V values were calculated by this equation: Reflectance = $1.2219V-0.2311V^2 + 0.2395V^3-0.021009V^4 + 0.0008404V^5$.

6.8.4. The density values from the reflectance values were calculated by this equation: D = -log(Reflectance/102.56)

6.8.5. The trapping percentages were calculated from the density values by using the following equations:

% trapping of Y over M = (Rdensity-Mdensity/Ydensity) *100

% trapping of M over Y = (Rdensity-Ydensity/Mdensity) *100

% trapping of Y over C = (Gdensity-Mdensity/Ydensity) *100

% trapping of C over Y = (Gdensity-Ydensity/Cdensity) *100

% trapping of M over C = (Bdensity-Cdensity/Mdensity) *100

% trapping of C over M = (Bdensity-Mdensity/Cdensity) *100

6.9. The L* a* b*color gamuts from the cyan, magenta, yellow, red, green, and blue colors of the four sequences were plotted.

6.10. The expected L* a* b* values of the red, green, and blue colors were plotted in order to show the ΔC_{ab}* and ΔH_{ab}.

CHAPTER 5

RESULTS

I. The Characteristics of the variables under study

1. Table 3: The L* a* b* values of the ideal inks.

	L*	a*	b*
Ideal Cyan	95.17	-30.14	-2.00
Ideal Magenta	63.57	68.57	-55.13
Ideal Yellow	95.65	-15.00	123.02
Ideal Red	48.37	80.50	110.99
Ideal Green	90.40	-52.50	-85.80

From table 3, the L* a* b* values of the ideal inks were very high because they were generated from the assumption that the ideal cyan, magenta, and yellow inks should absorb one-third and reflect two-thirds of the spectrum band. The ideal red, green, and blue inks should absorb two-thirds and reflect one-third of the spectrum.

2. Table 4: The mean of the L* a* b* measured from 30 samples of the YMCK, YCMK, CMYK, and KCMY sequences.

	CYAN			MAGENTA		
	L*	a*	b*	L*	a*	b*
YMCK	61.12	-33.39	-36.66	49.95	58.85	-11.70
YCMK	60.75	-34.84	-36.36	48.80	59.77	-11.07
CMYK	60.97	-34.82	-36.26	50.18	59.65	-11.60
KCMY	60.94	-34.70	-37.19	49.55	60.88	-10.78

	YELLOW			RED		
	L*	a*	b*	L*	a*	b*
YMCK	84.15	-5.67	96.74	53.17	42.45	57.88
YCMK	83.99	-8.10	97.02	49.70	46.30	55.32
CMYK	84.96	-6.74	93.98	48.62	52.38	45.81
KCMY	85.03	-6.62	95.67	48.15	53.75	48.11

	GREEN			BLUE		
	L*	a*	b*	L*	a*	b*
YMCK	55.76	-57.08	34.91	32.30	19.34	-39.42
YCMK	56.54	-56.81	37.69	32.35	10.46	-41.02
CMYK	54.75	-59.20	26.58	34.16	10.87	-41.23
KCMY	54.13	-59.71	29.45	32.47	12.67	-41.68

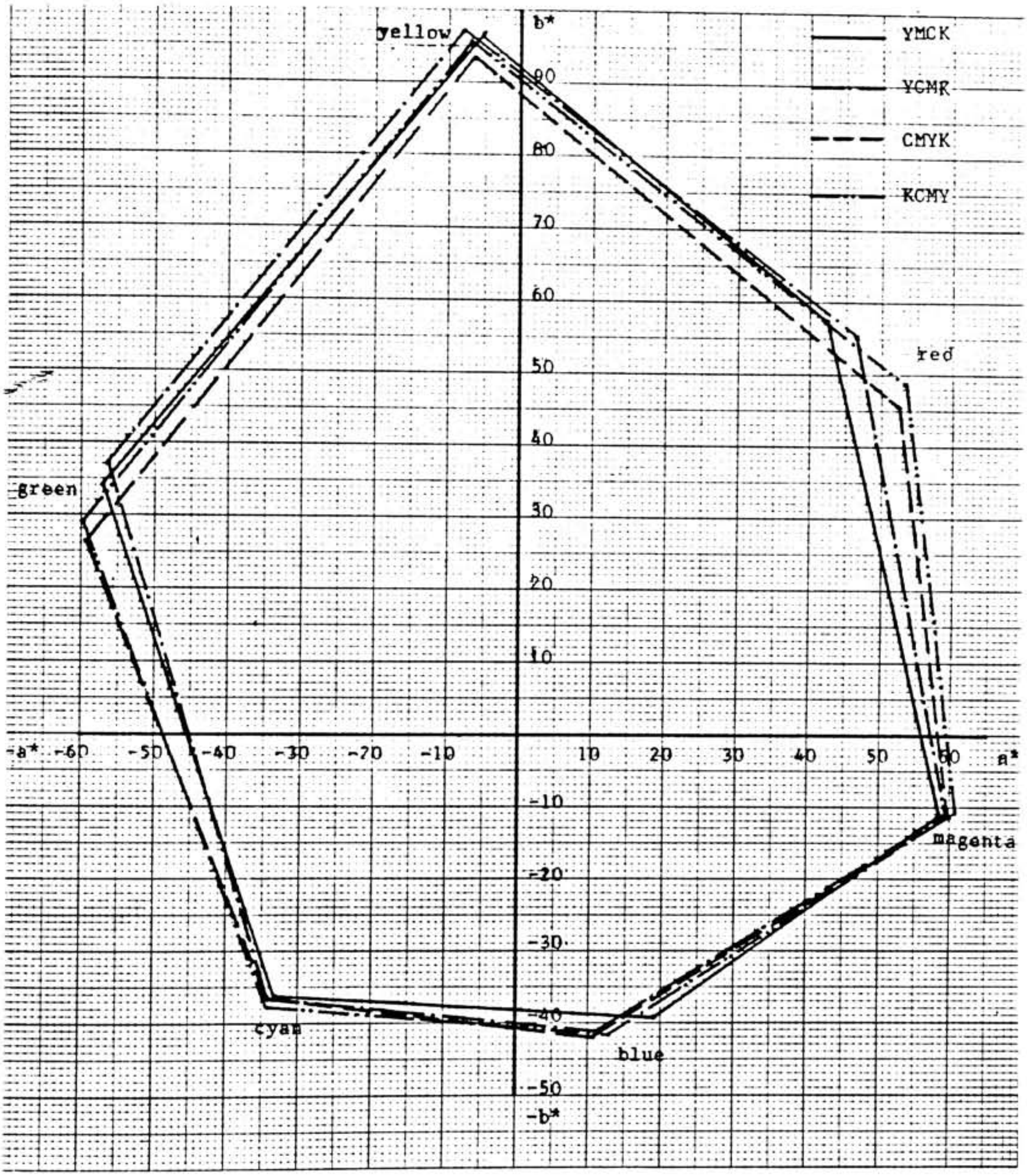
From table 4, the L* a* b* values of the cyan, magenta, and yellow patches of the four sequences did not vary much from one another. On the other hand, the L* a* b* values of the red, green, and blue patches do differ from one another.

The red patches, the L* a* b* values of YMCK, YCMK and CMYK, KCMY were close to each other.

The same is seen for the green patches, where the L* a* b* values of YMCK, YCMK and CMYK, KCMY were alike.

However, for the blue patches, the L* a* b* values of YCMK, CMYK, and KCMY were alike, but they were different from those of the YMCK.

Figure 1. The color gamuts of the four different ink sequences plotted on the CIE LAB color space.



3. Table 5: The color differences of the cyan, magenta, yellow, red, green, and blue colors between the practical process inks under study and the ideal inks.

	ΔE Cyan	ΔE Magenta	ΔE Yellow	ΔE Red	ΔE Green	ΔE Blue
YMCK	48.70	46.54	30.17	65.51	88.49	98.35
YCMK	48.86	48.29	29.32	65.35	85.57	105.48
CMYK	48.64	46.33	34.36	70.99	96.68	104.81
KCMY	49.31	48.06	30.51	68.34	94.31	102.87

The matching acceptable tolerance for lithographic reproduction is in the order of 6 CIE LAB color difference units.[1] The table 5 can be explained as follows:

The colors of the primary printing inks (: cyan, magenta, and yellow) of the four sequences were not visually different from one another because the color differences of each color did not differ from one another over the 6 CIE LAB color difference units. This statement proves that the process control of the solid ink densities of the four sequences was successful. For the red colors of the four sequences, the red color differences of each sequence were not higher than 6. It can be concluded that the red color produced by the four printing sequence were not visually different. For the green colors of the four sequences, the green color of the YMCK and YCMK sequences were not visually different from each other, as well as those of the CMYK and KCMY. However, the green colors of the YMCK,YCMK and the CMYK,KCMY are slightly different. For the blue colors of the four sequences, the blue colors of the YCMK, CMYK, and KCMY were not visually different from one another. The blue of YMCK was visually different from those of the YCMK and CMYK; but it was not visually different from that of the KCMY.

4. Table 6: The mean of the filtered densities (subtracted off the paper densities) of the cyan, magenta, yellow, red, green, and blue patches of the four ink sequences under study.

YMCK SEQUENCE

	CYAN	MAGENTA	YELLOW	RED	GREEN	BLUE
R filter	1.21	0.13	0.02	0.10	1.06	1.00
G filter	0.39	1.08	0.06	0.82	0.40	1.24
B filter	0.11	0.55	0.99	1.38	0.88	0.50
V filter	0.28	0.74	0.22	0.83	0.55	0.88

YCMK SEQUENCE

	CYAN	MAGENTA	YELLOW	RED	GREEN	BLUE
R filter	1.25	0.13	0.03	0.12	1.03	1.17
G filter	0.39	1.12	0.05	0.93	0.38	1.18
B filter	0.10	0.57	1.05	1.44	0.87	0.54
V filter	0.28	0.76	0.23	0.92	0.53	0.85

CMYK SEQUENCE

	CYAN	MAGENTA	YELLOW	RED	GREEN	BLUE
R filter	1.26	0.12	0.02	0.17	1.12	1.83
G filter	0.40	1.10	0.05	1.04	0.42	1.13
B filter	0.11	0.55	0.99	1.33	0.79	0.52
V filter	0.29	0.74	0.23	0.97	0.56	0.82

KCMY SEQUENCE

	CYAN	MAGENTA	YELLOW	RED	GREEN	BLUE
R filter	1.27	0.12	0.02	0.12	1.19	1.15
G filter	0.40	1.13	0.06	1.08	0.43	1.20
B filter	0.11	0.57	1.03	1.40	0.85	0.55
V filter	0.29	0.76	0.23	0.99	0.58	0.86

5. Table 7: The densitometric trapping percentages of the four ink sequences under study.

% TRAP (DENSITOMETRIC VALUES)

	RED	GREEN	BLUE
YMCK	70.46	86.74	71.91
YCMK	78.01	79.71	69.99
CMYK	79.11	68.76	66.67
KCMY	80.29	71.65	70.85

This table shows that the trapping percentage of the red color for the KCMY sequence was the highest (80.29%). Second ranked was that of the CMYK sequence (79.11%), third that of the YCMK sequence (78.01%), and fourth that of the YMCK sequence (70.46%).

The trapping percentage of the green color for the YMCK sequence was the highest (86.74%). Second ranked was that of the YCMK sequence (79.71%). Third was that of the KCMY sequence (71.65%), and fourth was that of the CMYK sequence (68.76%).

The trapping percentage of the blue color for the YMCK sequence was the highest (71.91%). Second was that of the KCMY sequence (70.85%); third that of the YCMK sequence (69.99%); and fourth that of the CMYK sequence (66.67%).

6. Table 8: The expected L* a* b* values of the red, green, and blue colors which were calculated from the filtered densities of the primary cyan, magenta, and yellow inks.

L* a* b* Expected from the Filtered Densities

	RED			GREEN			BLUE		
	L*	a*	b*	L*	a*	b*	L*	a*	b*
YMCK	44.69	50.50	44.40	60.01	-24.00	46.00	29.51	9.00	-36.00
YCMK	37.62	63.50	36.60	59.83	-27.50	48.00	27.69	7.50	-31.20
CMYK	44.46	51.00	44.80	59.92	-24.00	45.40	29.79	10.00	-37.20
KCMY	43.87	50.00	46.00	59.16	-24.55	46.60	28.88	9.00	-37.00

From the table, the L* a* b* expected values proved to be different from those of the measured ones.

7. Table 9: The ΔC_{ab}* and ΔH_{ab} between the C_{ab}* and the H_{ab} values of the expected red, green, and blue and the measured red, green, and blue.

		ΔC_{ab}	ΔH_{ab}
YMCK	RED	4.53	15.03
	GREEN	15.02	31.48
	BLUE	6.80	8.51

		ΔC_{ab}	ΔH_{ab}
YCMK	RED	1.15	25.40
	GREEN	12.85	28.28
	BLUE	10.24	0.51
CMYK	RED	1.70	0.15
	GREEN	13.53	37.55
	BLUE	4.12	0.20
KCMY	RED	4.19	0.95
	GREEN	13.91	36.56
	BLUE	56.48	2.30

For the red color, the ΔC_{ab} of the YMCK was the highest (4.53). Second ranked was that of the KCMY sequence (4.19); third was that of the CMYK sequence (1.70); and fourth rank was that of the YCMK sequence (1.15). The ΔH_{ab} of the YCMK sequence was the highest (25.40). Second ranked was that of the YMCK sequence (15.03); third that of the KCMY sequence (0.95); and fourth rank that of the CMYK sequence (0.15).

For the green color, the ΔC_{ab} of the YMCK sequence was the highest (15.02). Second ranked was that of the KCMY sequence (13.91); third rank that of the CMYK sequence (13.53); and fourth rank that of the YCMK sequence (12.85). The ΔH_{ab} of the CMYK sequence was the highest (37.55). Second ranked was that of the KCMY sequence (36.56); third that of the YMCK sequence (31.48); and fourth that of the YCMK sequence (28.28).

For the blue color, the ΔC_{ab} of the YCMK sequence was the highest (10.24). Second ranked was that of the YMCK sequence (6.8); third that of the KCMY sequence (5.48); and fourth that of the CMYK sequence (4.12). The ΔH_{ab} of the YMCK sequence was the highest (8.51). The second rank was that of the KCMY sequence (2.3); third rank that of the YCMK sequence (0.51); and fourth that of the CMYK sequence (0.20).

Figure 2. The plots of hue angle and chroma shifts of the overprint colors from what was predicted on the CIE LAB color space. (YMCK.)

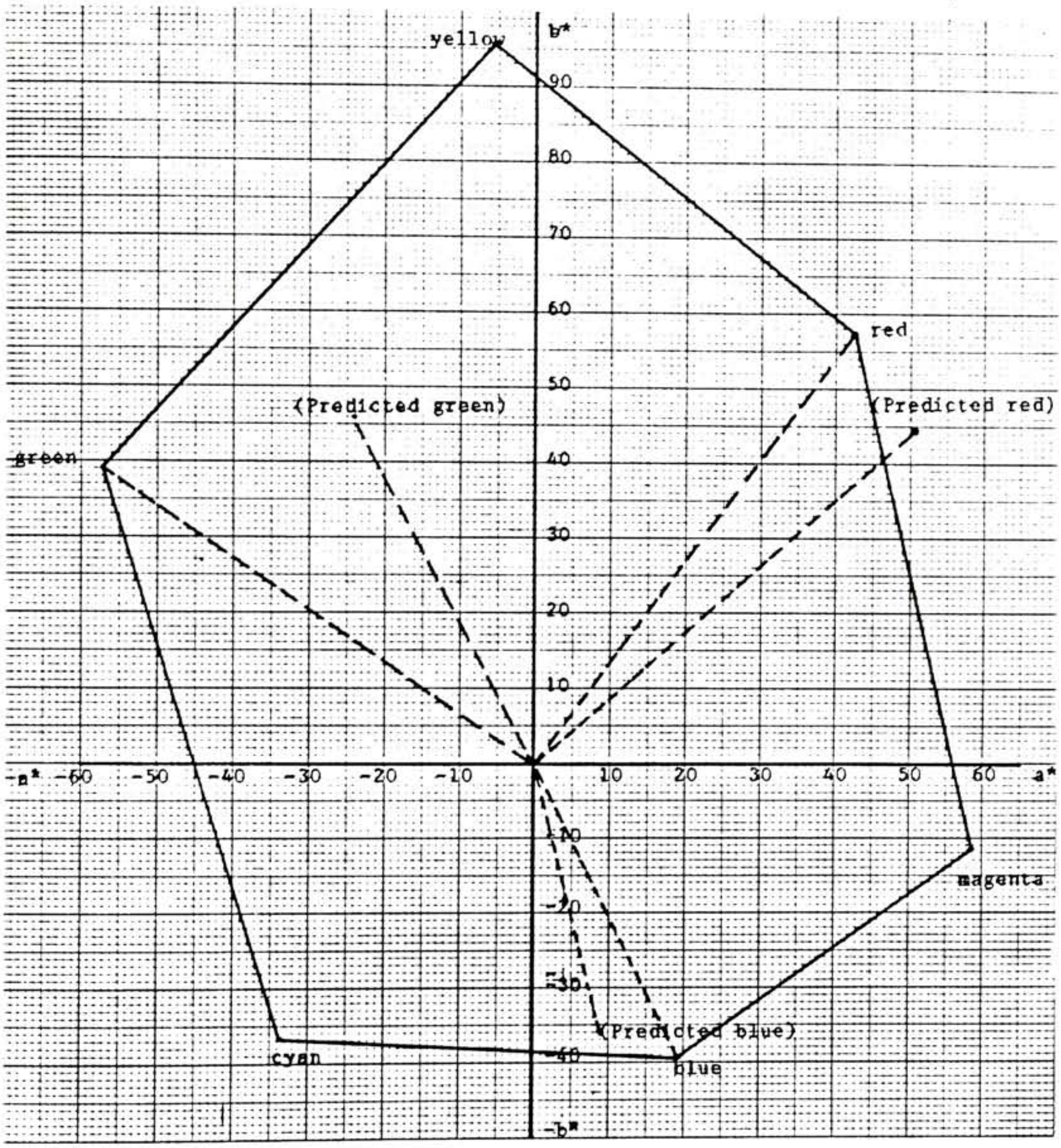


Figure 3. The plots of hue angle and chroma shifts of the overprint colors from what was predicted on the CIE LAB color space. (YCMK.)

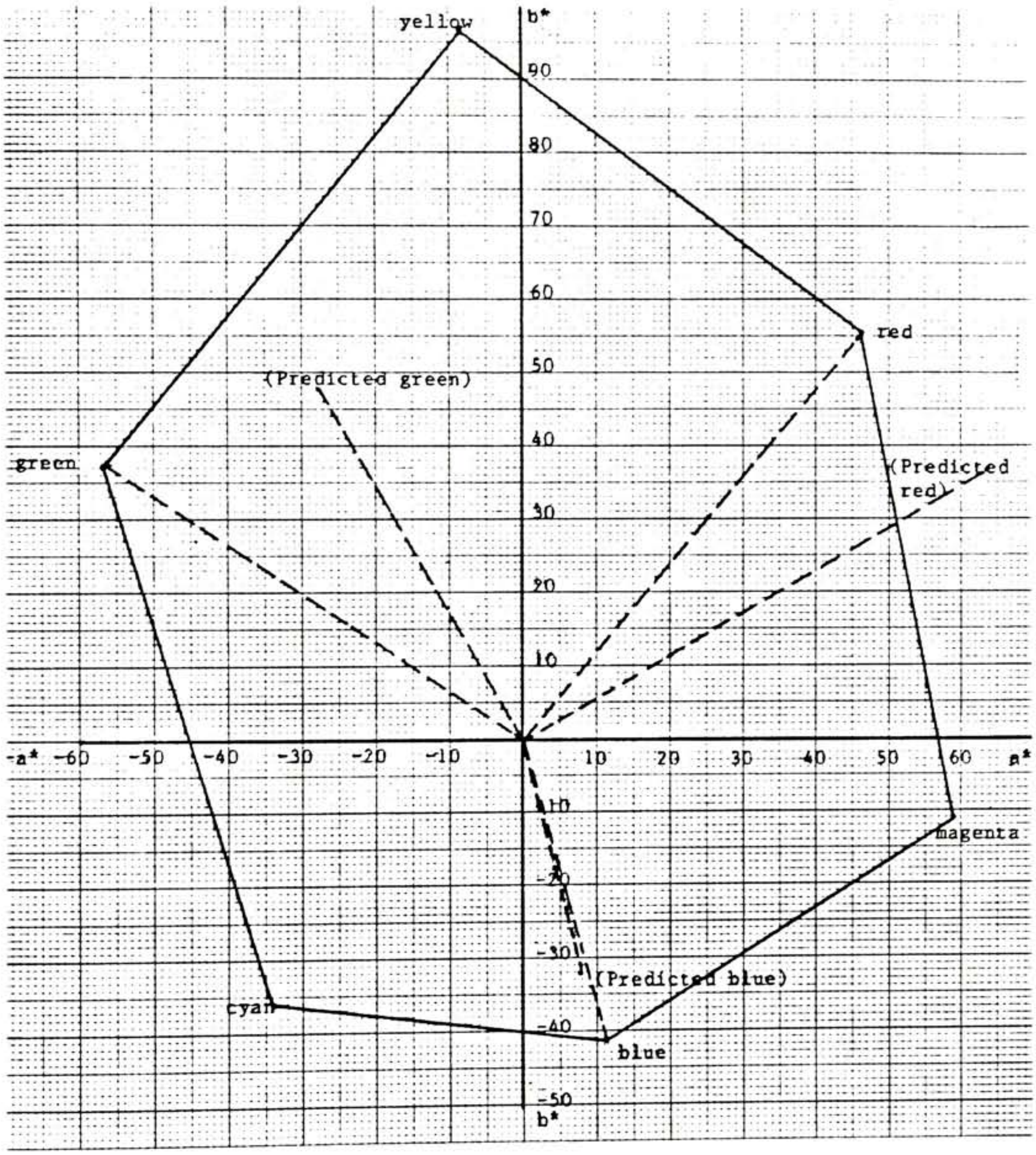


Figure 4. The plots of hue angle and chroma shifts of the overprint colors from what was predicted on the CIE LAB color space. (CMYK.)

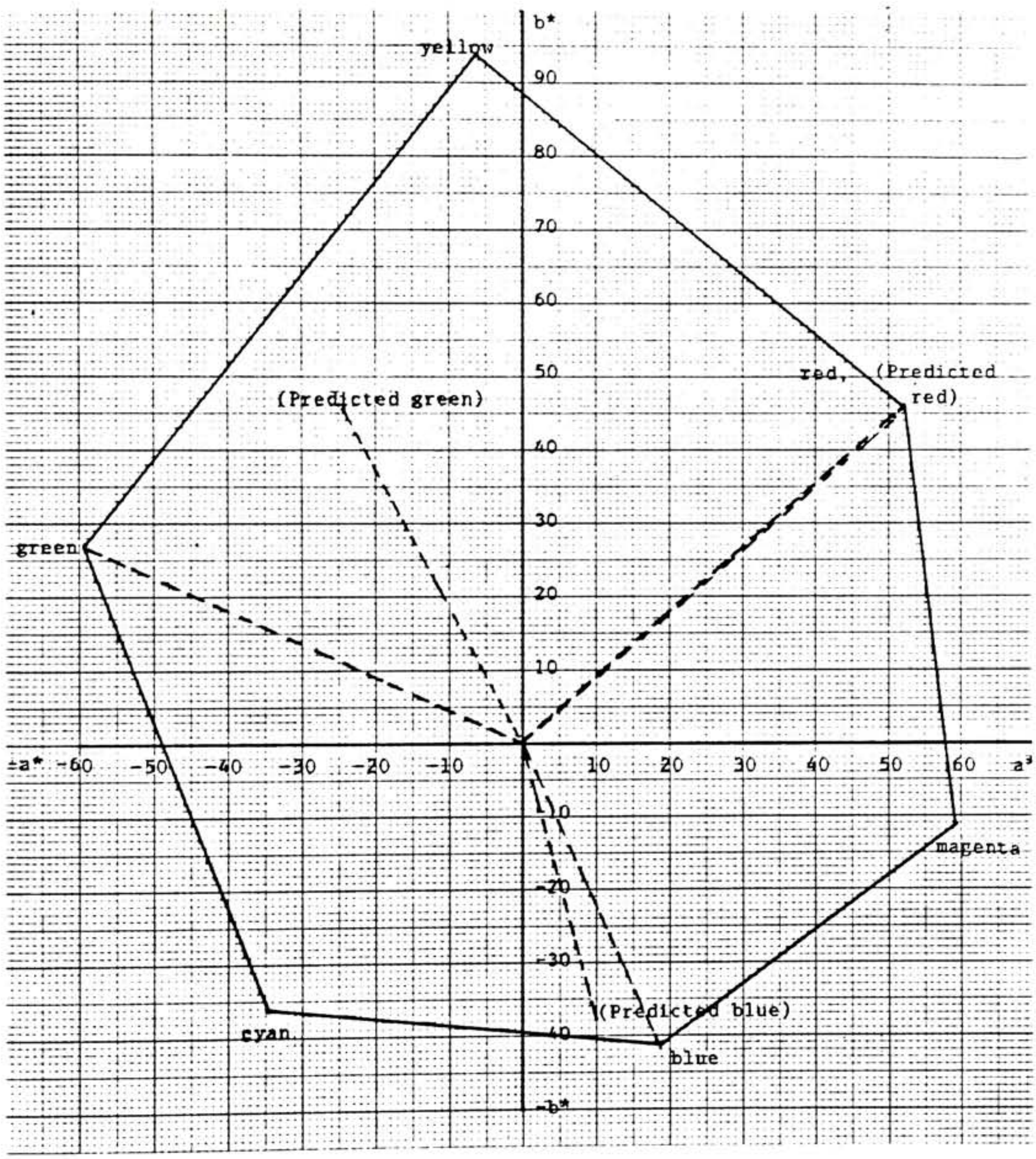
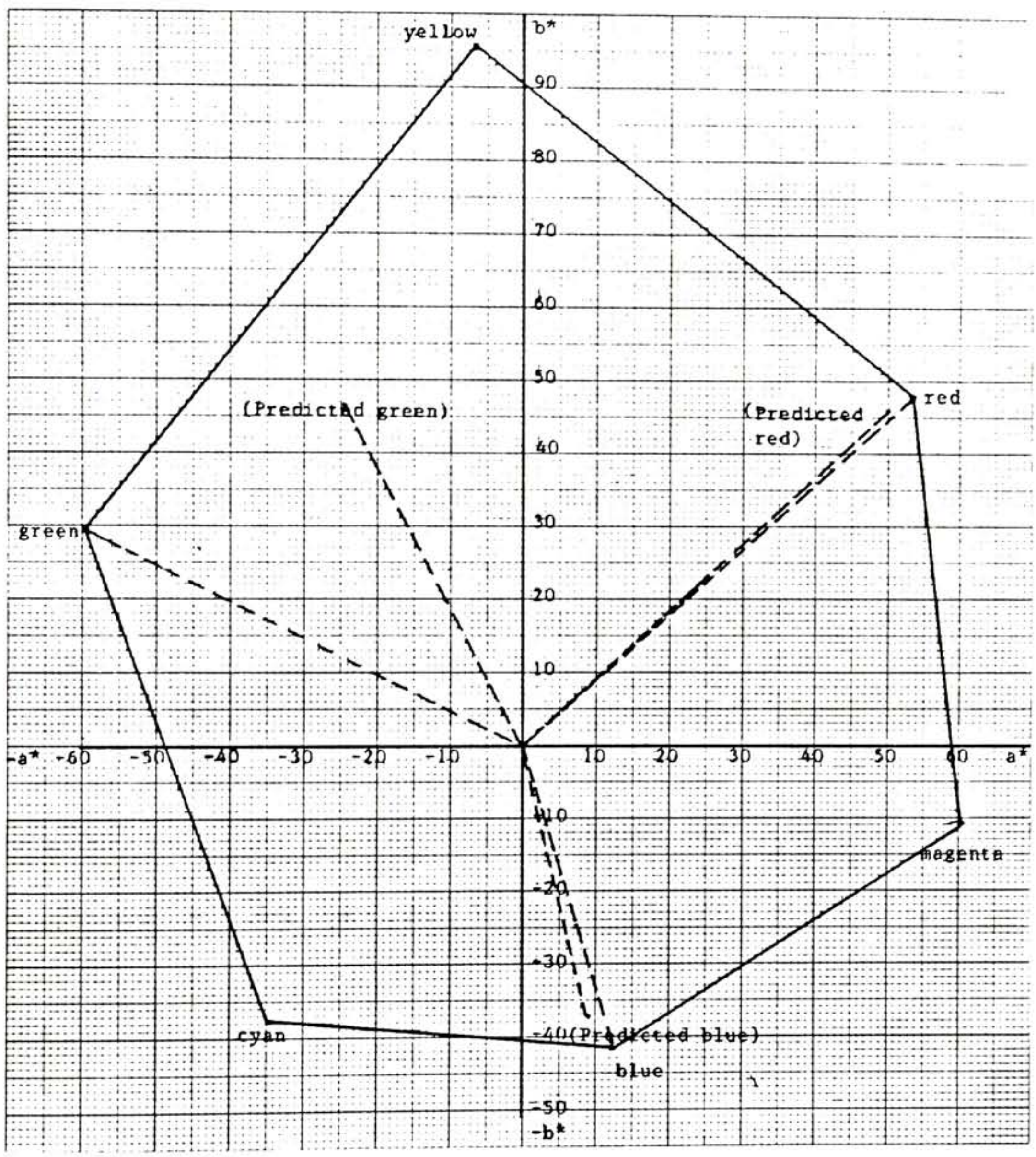


Figure 5. The plots of hue angle and chroma shifts of the overprint colors from what was predicted on the CIE LAB color space. (KCMY.)



8. Table 10: The trapping percentages of the four ink sequences calculated from the L* values.

% TRAP (COLORIMETRIC VALUES)

	RED	GREEN	BLUE
YMCK	64.65	79.61	66.58
YCMK	70.94	75.53	61.68
CMYK	15.37	55.87	55.51
KCMY	13.94	61.69	58.10

This table shows that the trapping percentage of the red color for the YCMK sequence was the highest (70.94%). Second ranked was that of the YMCK sequence (64.65%), third rank the CMYK sequence (15.37%), and fourth rank the KCMY sequence (13.95%).

The trapping percentage of the green color for the YMCK sequence was the highest (79.61%). Second ranked was that of the YCMK sequence (75.53%); third rank that of the KCMY sequence (61.69%);and fourth that of the CMYK sequence (55.87%).

The trapping percentage of the blue color for the YMCK sequence was the highest (66.58%). Second ranked was that of the YCMK sequence (61.68%); third that of the KCMY sequence (58.10%); and fourth that of the CMYK sequence (55.51%).

II. The analysis of
the relationships between
the dependent and independent variables

1. Table 11: The relationships between the percent ink trapping and the ΔE of the overprint colors between the practical and the ideal inks.

RED

	% TRAP	ΔE
YMCK	70.46	65.51
YCMK	78.01	65.35
CMYK	79.11	70.99
KCMY	80.29	68.34

GREEN

	% TRAP	ΔE
YMCK	86.74	88.49
YCMK	79.71	85.57
CMYK	68.76	96.68
KCMY	71.65	94.31

BLUE

	% TRAP	ΔE
YMCK	71.91	98.35
YCMK	69.99	105.48
CMYK	66.67	104.81
KCMY	70.85	102.87

For the red color, the different trapping percentage was not visually different in the red patches of the four sequences. This means that the trapping of yellow over magenta or magenta over yellow yielded the same visual effect. The percent trappings of 70.46, 78.01, 79.11, and 80.29 were not different in producing the same color appearance.

On the other hand, for the green color, the different trapping percentages did cause the visually difference in the green patches of the four sequences. The percent trapping of 86.74 %for the YMCK sequence, and of 79.71% for the YCMK sequence, yielded the same visual effect because the ΔE values were not over 6 units. The percent trapping of 68.76 for the CMYK sequence, and 71.65 for the KCMY sequence, also yield the same color appearance because the ΔE values were not over 6 units. The color appearances of green produced from the YMCK and YCMK sequences (cyan over yellow) were slightly visually different from those produced from the CMYK and the KCMY sequences (yellow over cyan) because the ΔE values were different from each other over 6 units, but not more than 12 units.

For the blue color, the different trapping percentages did not satisfactorily prove that they cause the different color appearances. The trapping of 71.91% for the YMCK sequence (ΔE=98.35) yielded the different color appearance from the trapping of 69.99% for the YCMK sequence (ΔE= 105.48), of 66.67% for the CMYK sequence (ΔE=104.81), but not different from the trapping of 70.85% for the KCMY sequence (ΔE=102.84). The

trapping of 69.99 % for the YMCK sequence, the trapping of 66.67% for the CMYK sequence, and the trapping of 70.85% yields the same color appearance since ΔE values did not differ for more than 6 from one another. It can be concluded that the trapping of magenta over cyan, or cyan over magenta did not yield a significantly perceivable difference in color appearances.

2. Table 12: The relationships between the percent ink trapping calculated from the L* values and the ΔE of the overprint colors between the practical and the ideal inks.

RED

	% TRAP	ΔE
YMCK	64.65	65.51
YCMK	70.94	65.35
CMYK	15.37	70.99
KCMY	13.95	68.34

GREEN

	% TRAP	ΔE
YMCK	79.61	88.49
YCMK	75.53	85.57
CMYK	55.87	96.68
KCMY	61.69	96.68

BLUE

	% TRAP	ΔE
YMCK	71.91	98.35
YCMK	61.68	105.48
CMYK	55.51	104.81
KCMY	58.10	102.87

From the table, for the red color, it was shown that the trapping of magenta over yellow was far more different than that of the yellow over magenta. However, they produced the same color appearance because the ΔE value did not differ for more than 6 from one another.

For the green color, the different trapping percentages did cause visually differences in the green patches of the four sequences. The percent trap of 79.61 % for the YMCK sequence and of 75.53% for the YCMK sequence yielded the same visual effect because the ΔE values were not over 6 units. The trapping of 55.86% for the CMYK sequence and, 61.69% for the KCMY sequence also yield the same color appearance because the ΔE values were not over 6 units. The color appearances of green produced from the YMCK and YCMK sequences (cyan over yellow) were slightly visually different from that produced from the CMYK and the KCMY sequences (yellow over cyan) because the ΔE values were different from each other over 6 units but not more than 12 units.

For the blue color, the different trapping percentages did not satisfactorily prove that they cause the different color appearances. The trapping of 66.58% for the YMCK sequence (ΔE=98.35) yielded the different color appearance from the trapping of 61.68% for the YCMK sequence (ΔE= 105.48), of 55.51% for the CMYK sequence (ΔE=104.81), but not different from the trapping of 58.10% for the KCMY sequence (ΔE=102.84). The trapping of 66.58% for the YMCK sequence, the trapping of 55.51% for the CMYK

sequence, and the trapping of 58.10% for the KCMY sequence yields the same color appearance since ΔE values did not differ for more than 6 from one another . It can be concluded that the trapping of magenta over cyan or cyan over magenta did not yield a signigficantly difference in color appearances.

It is worth noticing that the Preucil trapping equation did not work well in the application to the colorimetric trapping values because it underestimated the trapping of the yellow over magenta.

III. Visual evaluation of the prints

All the images printed by changing the four printing orders were viewed under the 5000 K light. The subjective evaluation of the images are as follows:

For the high key images, all printing orders produced similar color reproduction;

For the flesh tone domained images,the sequences YMCK and YCMK produced yellowish skin tone; the sequence KCMY produced reddish skin tone; but the CMYK produced normal skin tone;

For the normal key images, there were no noticeable difference;

For the low key images, the sequences YCMK-CMYK produced brownish gray but KCMY-YMCK produced neutral gray;

For the color patches, all the sequences produced similar green; the sequences YMCK and YCMK produced different red from KCMY and YMCK; and the sequences KCMY and YMCK produced different blue from YCMK and CMYK.

FOOTNOTES FOR CHAPTER 5

1. Milton Pearson,"Image Reproduction Colorimetry", Color Research and Application vol. 11, no. 1 (Spring 1986), p.48.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

The hypotheses testing

1. The first hypothesis: each of the four different ink sequences will yield a different color gamut on the CIE LAB color space, was rejected.

From table 5, the YMCK and YCMK sequences yield insignificantly different color gamut and so did the CMYK and KCMY sequences. The sequence CMYK yields significantly different color gamut from the YMCK and YCMK.

2. The second hypothesis: the YMCK and CMYK sequences will have similar color gamuts, was rejected.

From table 5, theYMCK and CMYK have significantly different color gamuts. They produced visually different green.

3. The ink sequence which yields the highest color differences from the colors of the ideal inks will have the lowest percent ink trapping among each laid-down colors.

Table 13: The total percent trapping of red, green, and blue and the total ΔE values of the four ink sequences.

	TOTAL % TRAP	ΔE
YMCK	229.11	252.35
YCMK	227.71	256.40
CMYK	214.54	272.48
KCMY	222.79	265.52

From the table, the sequence CMYK had the highest color differences and it had the lowest percent ink trapping. Therefore, the third hypothesis was failed to reject.

The most suitable ink sequences for this study are the sequence YMCK and YCMK because they yielded similar color gamuts and had lower Δ E of all colors than the others.

It can be concluded that the changing of ink sequences of the monotack ink in the web-offset printing caused different color gamuts on the CIE LAB color space. The apparent wet-trapping degrees caused the hue and chroma shift which resulted in the different color gamuts. However, the different gamuts on the CIE LAB color space, which were dealt with two values: the redness-greenness and the yellowness-blueness, did not indicate that they were the results of changing printing orders. The study of the color differences, which are the total effect of the redness-greenness, the yellowness-blueness, and the lightness-darkness, can tell whether the change of the printing orders affect the color appearances or not.

It was found that, for the monotack inks under study, the trapping of yellow over magenta did not yield different color appearances from the trapping of magenta over yellow. This means that the red colors produced by alternating yellow and magenta were alike. Furthermore, the trapping of cyan over yellow yielded a different color appearance from the trapping of yellow over cyan. This means that the green colors produced by alternating yellow and cyan were visually different. And the trapping of cyan over magenta did not yield a different color appearance from the trapping of magenta over cyan. This means that the blue colors produced by alternating cyan and magenta were alike. These findings did not correspond to the visual evaluation under the light source of 5000 K .

The subjective evaluation found that the red patches produced by alternating yellow and magenta were slightly different. The green patches produced by all printing orders were alike. The blue patches produced by alternating cyan and magenta were slightly different. The difference between the color temperature of the instrument used (6500 K)

and the viewing light (5000 K) may be the major cause of metamerism. For the high key images, all printing orders produced similar color reproduction. For the flesh tone domained images, the sequences YMCK and YCMK produced yellowish skin tone; the sequence KCMY produced reddish skin tone; but the CMYK produced normal skin tone. For the normal key images, there were no noticeable difference. For the low key images, the sequences YCMK-CMYK produced brownish gray but KCMY-YMCK produced neutral gray.

The two sequences, YMCK and CMYK, which were recommended by Gary Field to be adoped as standard sequences for SWOP inks, did not have the similar color gamut on the CIE LAB color space. They certainly produced visually different green. Furthermore, it was found that the most suitable ink sequence was yellow-magenta-cyan-black because it gave the highest trapping percentages and had the least total color differences from the ideal inks.

The densitometric apparent trapping percentages calculated from the Preucil's equation explain the higher percent trap, the lower color differences of the green and blue from the ideal inks well, but fail to explain the red trapping.

The colorimetric apparent trapping percentages which calculated from the L* values by using the Preucil's concept was not valid because it resulted in a very wide range of yellow-magenta trapping which contradicted the insignificant color differences.

The recommendations for further study are as follows:

1. Larger sample sizes are required.

2. Other ink sequences should be studied.

3. The method of calculating the colorimetric trapping percentage is yet to be found.

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APPENDICES

APPENDIX A

The L* a* b* Values of the Ideal Inks

Table 14: The L* a* b* values of the ideal cyan ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	1	50	0.0002	0	0.0007	0.01	0	0.035	0
390	1	54.6	0.0024	0.0003	0.0105	0.13104	0.01638	0.5733	0.01638
400	1	82.8	0.0191	0.002	0.086	1.58148	0.1656	7.1208	0.1656
410	1	91.5	0.0847	0.0088	0.3894	7.75005	0.8052	35.6301	0.8052
420	1	93.4	0.2045	0.0214	0.9725	19.1003	1.99876	90.8315	1.99876
430	1	86.7	0.3147	0.0387	1.5535	27.28449	3.35529	134.6884	3.35529
440	1	104.9	0.3837	0.0621	1.9673	40.25013	6.51429	206.3698	6.51429
450	1	117	0.3707	0.0895	1.9948	43.3719	10.4715	233.3916	10.4715
460	1	117.8	0.3023	0.1282	1.7454	35.61094	15.10196	205.6081	15.10196
470	1	114.9	0.1956	0.1852	0.3176	22.47444	21.27948	36.49224	21.27948
480	1	115.9	0.0805	0.2536	0.7721	9.32995	29.39224	89.48639	29.39224
490	1	108.8	0.0162	0.3391	0.4153	1.76256	36.89408	45.18464	36.89408
500	1	109.4	0.0038	0.4608	0.2185	0.41572	50.41152	23.9039	50.41152
510	1	107.8	0.0375	0.6067	0.112	4.0425	65.40226	12.0736	65.40226
520	1	104.8	0.1177	0.7618	0.0607	12.33496	79.83664	6.36136	79.83664
530	1	107.7	0.2365	0.8752	0.0305	25.47105	94.25904	3.28485	94.25904
540	1	104.4	0.3768	0.962	0.0137	39.33792	100.4328	1.43028	100.4328
550	1	104	0.5298	0.9918	0.004	55.0992	103.1472	0.416	103.1472
560	1	100	0.7052	0.9973	0	70.52	99.73	0	99.73
570	1	96.3	0.8787	0.9556	0	84.61881	92.02428	0	92.02428
580	1	95.8	1.0142	0.8689	0	97.16036	83.24062	0	83.24062
590	1	88.7	1.1185	0.7774	0	99.21095	68.95538	0	68.95538
600	1	90	1.124	0.6583	0	101.16	59.247	0	59.247
610	0	89.6	1.0305	0.528	0	0	0	0	47.3088
620	0	87.7	0.8563	0.3981	0	0	0	0	34.91337
630	0	83.3	0.6475	0.2835	0	0	0	0	23.61555
640	0	83.7	0.4316	0.1798	0	0	0	0	15.04926
650	0	80	0.2683	0.1076	0	0	0	0	8.608
660	0	82.2	0.1526	0.0603	0	0	0	0	4.95666
670	0	82.3	0.0813	0.0318	0	0	0	0	2.61714
680	0	78.3	0.0409	0.0159	0	0	0	0	1.24497
690	0	69.7	0.0199	0.0077	0	0	0	0	0.53669
700	0	71.6	0.0096	0.0037	0	0	0	0	0.26492
710	0	74.3	0.0046	0.0018	0	0	0	0	0.13374
720	0	61.6	0.0022	0.0008	0	0	0	0	0.04928
730	0	69.9	0.001	0.0004	0	0	0	0	0.02796
740	0	75.1	0.0005	0.0002	0	0	0	0	0.01502
750	0	63.6	0.0003	0.0001	0	0	0	0	0.00636
760	0	46.4	0.0001	0	0	0	0	0	0
770	0	66.8	0.0001	0	0	0	0	0	0
780	0	63.4	0	0	0	0	0	0	0
					Sum of	798.0287	1022.682	1132.882	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						68.67544	88.00824	97.49169	
						L*=	a*=	b*=	
						95.17	-30.14	-2	

Table 15: The L* a* b* values of the ideal magenta ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*A*z	S*y
380	1	50	0.0002	0	0.0007	0.01	0	0.035	0
390	1	54.6	0.0024	0.0003	0.0105	0.13104	0.01638	0.5733	0.01638
400	1	82.8	0.0191	0.002	0.086	1.58148	0.1656	7.1208	0.1656
410	1	91.5	0.0847	0.0088	0.3894	7.75005	0.8052	35.6301	0.8052
420	1	93.4	0.2045	0.0214	0.9725	19.1003	1.99876	90.8315	1.99876
430	1	86.7	0.3147	0.0387	1.5535	27.28449	3.35529	134.6884	3.35529
440	1	104.9	0.3837	0.0621	1.9673	40.25013	6.51429	206.3698	6.51429
450	1	117	0.3707	0.0895	1.9948	43.3719	10.4715	233.3916	10.4715
460	1	117.8	0.3023	0.1282	1.7454	35.61094	15.10196	205.6081	15.10196
470	1	114.9	0.1956	0.1852	0.3176	22.47444	21.27948	36.49224	21.27948
480	1	115.9	0.0805	0.2536	0.7721	9.32995	29.39224	89.48639	29.39224
490	1	108.8	0.0162	0.3391	0.4153	1.76256	36.89408	45.18464	36.89408
500	1	109.4	0.0038	0.4608	0.2185	0.41572	50.41152	23.9039	50.41152
510	0	107.8	0.0375	0.6067	0.112	0	0	0	65.40226
520	0	104.8	0.1177	0.7618	0.0607	0	0	0	79.83664
530	0	107.7	0.2365	0.8752	0.0305	0	0	0	94.25904
540	0	104.4	0.3768	0.962	0.0137	0	0	0	100.4328
550	0	104	0.5298	0.9918	0.004	0	0	0	103.1472
560	0	100	0.7052	0.9973	0	0	0	0	99.73
570	0	96.3	0.8787	0.9556	0	0	0	0	92.02428
580	0	95.8	1.0142	0.8689	0	0	0	0	83.24062
590	0	88.7	1.1185	0.7774	0	0	0	0	68.95538
600	1	90	1.124	0.6583	0	101.16	59.247	0	59.247
610	1	89.6	1.0305	0.528	0	92.3328	47.3088	0	47.3088
620	1	87.7	0.8563	0.3981	0	75.09751	34.91337	0	34.91337
630	1	83.3	0.6475	0.2835	0	53.93675	23.61555	0	23.61555
640	1	83.7	0.4316	0.1798	0	36.12492	15.04926	0	15.04926
650	1	80	0.2683	0.1076	0	21.464	8.608	0	8.608
660	1	82.2	0.1526	0.0603	0	12.54372	4.95666	0	4.95666
670	1	82.3	0.0813	0.0318	0	6.69099	2.61714	0	2.61714
680	1	78.3	0.0409	0.0159	0	3.20247	1.24497	0	1.24497
690	1	69.7	0.0199	0.0077	0	1.38703	0.53669	0	0.53669
700	1	71.6	0.0096	0.0037	0	0.68736	0.26492	0	0.26492
710	1	74.3	0.0046	0.0018	0	0.34178	0.13374	0	0.13374
720	1	61.6	0.0022	0.0008	0	0.13552	0.04928	0	0.04928
730	1	69.9	0.001	0.0004	0	0.0699	0.02796	0	0.02796
740	1	75.1	0.0005	0.0002	0	0.03755	0.01502	0	0.01502
750	1	63.6	0.0003	0.0001	0	0.01908	0.00636	0	0.00636
760	1	46.4	0.0001	0	0	0.00464	0	0	0
770	1	66.8	0.0001	0	0	0.00668	0	0	0
780	1	63.4	0	0	0	0	0	0	0
					Sum of	614.3157	375.0010	1109.316	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						52.86577	32.27122	95.46367	
						L*=	a*=	b*=	
						63.57	68.57	(55.13)	

Table 16: The L* a* b* values of the ideal yellow ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0	50	0.0002	0	0.0007	0	0	0	0
390	0	54.6	0.0024	0.0003	0.0105	0	0	0	0.01638
400	0	82.8	0.0191	0.002	0.086	0	0	0	0.1656
410	0	91.5	0.0847	0.0088	0.3894	0	0	0	0.8052
420	0	93.4	0.2045	0.0214	0.9725	0	0	0	1.99876
430	0	86.7	0.3147	0.0387	1.5535	0	0	0	3.35529
440	0	104.9	0.3837	0.0621	1.9673	0	0	0	6.51429
450	0	117	0.3707	0.0895	1.9948	0	0	0	10.4715
460	0	117.8	0.3023	0.1282	1.7454	0	0	0	15.10196
470	0	114.9	0.1956	0.1852	0.3176	0	0	0	21.27948
480	0	115.9	0.0805	0.2536	0.7721	0	0	0	29.39224
490	0	108.8	0.0162	0.3391	0.4153	0	0	0	36.89408
500	1	109.4	0.0038	0.4608	0.2185	0.41572	50.41152	23.9039	50.41152
510	1	107.8	0.0375	0.6067	0.112	4.0425	65.40226	12.0736	65.40226
520	1	104.8	0.1177	0.7618	0.0607	12.33496	79.83664	6.36136	79.83664
530	1	107.7	0.2365	0.8752	0.0305	25.47105	94.25904	3.28485	94.25904
540	1	104.4	0.3768	0.962	0.0137	39.33792	100.4328	1.43028	100.4328
550	1	104	0.5298	0.9918	0.004	55.0992	103.1472	0.416	103.1472
560	1	100	0.7052	0.9973	0	70.52	99.73	0	99.73
570	1	96.3	0.8787	0.9556	0	84.61881	92.02428	0	92.02428
580	1	95.8	1.0142	0.8689	0	97.16036	83.24062	0	83.24062
590	1	88.7	1.1185	0.7774	0	99.21095	68.95538	0	68.95538
600	1	90	1.124	0.6583	0	101.16	59.247	0	59.247
610	1	89.6	1.0305	0.528	0	92.3328	47.3088	0	47.3088
620	1	87.7	0.8563	0.3981	0	75.09751	34.91337	0	34.91337
630	1	83.3	0.6475	0.2835	0	53.93675	23.61555	0	23.61555
640	1	83.7	0.4316	0.1798	0	36.12492	15.04926	0	15.04926
650	1	80	0.2683	0.1076	0	21.464	8.608	0	8.608
660	1	82.2	0.1526	0.0603	0	12.54372	4.95666	0	4.95666
670	1	82.3	0.0813	0.0318	0	6.69099	2.61714	0	2.61714
680	1	78.3	0.0409	0.0159	0	3.20247	1.24497	0	1.24497
690	1	69.7	0.0199	0.0077	0	1.38703	0.53669	0	0.53669
700	1	71.6	0.0096	0.0037	0	0.68736	0.26492	0	0.26492
710	1	74.3	0.0046	0.0018	0	0.34178	0.13374	0	0.13374
720	1	61.6	0.0022	0.0008	0	0.13552	0.04928	0	0.04928
730	1	69.9	0.001	0.0004	0	0.0699	0.02796	0	0.02796
740	1	75.1	0.0005	0.0002	0	0.03755	0.01502	0	0.01502
750	1	63.6	0.0003	0.0001	0	0.01908	0.00636	0	0.00636
760	1	46.4	0.0001	0	0	0.00464	0	0	0
770	1	66.8	0.0001	0	0	0.00668	0	0	0
780	1	63.4	0	0	0	0	0	0	0
					Sum of	893.4542	1036.034	47.46999	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						76.88741	89.15735	4.085094	
						L*=	a*=	b*=	
						95.65	(15.00)	123.02	

Table 17: The L* a* b* values of the ideal red ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*O*Z	S*y
380	0	50	0.0002	0	0.0007	0	0	0	0
390	0	54.6	0.0024	0.0003	0.0105	0	0	0	0.01638
400	0	82.8	0.0191	0.002	0.086	0	0	0	0.1656
410	0	91.5	0.0847	0.0088	0.3894	0	0	0	0.8052
420	0	93.4	0.2045	0.0214	0.9725	0	0	0	1.99876
430	0	86.7	0.3147	0.0387	1.5535	0	0	0	3.35529
440	0	104.9	0.3837	0.0621	1.9673	0	0	0	6.51429
450	0	117	0.3707	0.0895	1.9948	0	0	0	10.4715
460	0	117.8	0.3023	0.1282	1.7454	0	0	0	15.10196
470	0	114.9	0.1956	0.1852	0.3176	0	0	0	21.27948
480	0	115.9	0.0805	0.2536	0.7721	0	0	0	29.39224
490	0	108.8	0.0162	0.3391	0.4153	0	0	0	36.89408
500	0	109.4	0.0038	0.4608	0.2185	0	0	0	50.41152
510	0	107.8	0.0375	0.6067	0.112	0	0	0	65.40226
520	0	104.8	0.1177	0.7618	0.0607	0	0	0	79.83664
530	0	107.7	0.2365	0.8752	0.0305	0	0	0	94.25904
540	0	104.4	0.3768	0.962	0.0137	0	0	0	100.4328
550	0	104	0.5298	0.9918	0.004	0	0	0	103.1472
560	0	100	0.7052	0.9973	0	0	0	0	99.73
570	0	96.3	0.8787	0.9556	0	0	0	0	92.02428
580	0	95.8	1.0142	0.8689	0	0	0	0	83.24062
590	0	88.7	1.1185	0.7774	0	0	0	0	68.95538
600	1	90	1.124	0.6583	0	101.16	59.247	0	59.247
610	1	89.6	1.0305	0.528	0	92.3328	47.3088	0	47.3088
620	1	87.7	0.8563	0.3981	0	75.09751	34.91337	0	34.91337
630	1	83.3	0.6475	0.2835	0	53.93675	23.61555	0	23.61555
640	1	83.7	0.4316	0.1798	0	36.12492	15.04926	0	15.04926
650	1	80	0.2683	0.1076	0	21.464	8.608	0	8.608
660	1	82.2	0.1526	0.0603	0	12.54372	4.95666	0	4.95666
670	1	82.3	0.0813	0.0318	0	6.69099	2.61714	0	2.61714
680	1	78.3	0.0409	0.0159	0	3.20247	1.24497	0	1.24497
690	1	69.7	0.0199	0.0077	0	1.38703	0.53669	0	0.53669
700	1	71.6	0.0096	0.0037	0	0.68736	0.26492	0	0.26492
710	1	74.3	0.0046	0.0018	0	0.34178	0.13374	0	0.13374
720	1	61.6	0.0022	0.0008	0	0.13552	0.04928	0	0.04928
730	1	69.9	0.001	0.0004	0	0.0699	0.02796	0	0.02796
740	1	75.1	0.0005	0.0002	0	0.03755	0.01502	0	0.01502
750	1	63.6	0.0003	0.0001	0	0.01908	0.00636	0	0.00636
760	1	46.4	0.0001	0	0	0.00464	0	0	0
770	1	66.8	0.0001	0	0	0.00668	0	0	0
780	1	63.4	0	0	0	0	0	0	0
--------	--------...	--------	--------...	--------	--------...	--------...	--------...	--------	--------
					Sum of	405.2427	198.5947	0	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						34.87371	17.09034	0	
						L*=	a*=	b*=	
						48.37	80.50	110.99	

Table 18: The L* a* b* values of the ideal green ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0	50	0.0002	0	0.0007	0	0	0	0
390	0	54.6	0.0024	0.0003	0.0105	0	0	0	0.01638
400	0	82.8	0.0191	0.002	0.086	0	0	0	0.1656
410	0	91.5	0.0847	0.0088	0.3894	0	0	0	0.8052
420	0	93.4	0.2045	0.0214	0.9725	0	0	0	1.99876
430	0	86.7	0.3147	0.0387	1.5535	0	0	0	3.35529
440	0	104.9	0.3837	0.0621	1.9673	0	0	0	6.51429
450	0	117	0.3707	0.0895	1.9948	0	0	0	10.4715
460	0	117.8	0.3023	0.1282	1.7454	0	0	0	15.10196
470	0	114.9	0.1956	0.1852	0.3176	0	0	0	21.27948
480	0	115.9	0.0805	0.2536	0.7721	0	0	0	29.39224
490	0	108.8	0.0162	0.3391	0.4153	0	0	0	36.89408
500	1	109.4	0.0038	0.4608	0.2185	0.41572	50.41152	23.9039	50.41152
510	1	107.8	0.0375	0.6067	0.112	4.0425	65.40226	12.0736	65.40226
520	1	104.8	0.1177	0.7618	0.0607	12.33496	79.83664	6.36136	79.83664
530	1	107.7	0.2365	0.8752	0.0305	25.47105	94.25904	3.28485	94.25904
540	1	104.4	0.3768	0.962	0.0137	39.33792	100.4328	1.43028	100.4328
550	1	104	0.5298	0.9918	0.004	55.0992	103.1472	0.416	103.1472
560	1	100	0.7052	0.9973	0	70.52	99.73	0	99.73
570	1	96.3	0.8787	0.9556	0	84.61881	92.02428	0	92.02428
580	1	95.8	1.0142	0.8689	0	97.16036	83.24062	0	83.24062
590	1	88.7	1.1185	0.7774	0	99.21095	68.95538	0	68.95538
600	1	90	1.124	0.6583	0	101.16	59.247	0	59.247
610	0	89.6	1.0305	0.528	0	0	0	0	47.3088
620	0	87.7	0.8563	0.3981	0	0	0	0	34.91337
630	0	83.3	0.6475	0.2835	0	0	0	0	23.61555
640	0	83.7	0.4316	0.1798	0	0	0	0	15.04926
650	0	80	0.2683	0.1076	0	0	0	0	8.608
660	0	82.2	0.1526	0.0603	0	0	0	0	4.95666
670	0	82.3	0.0813	0.0318	0	0	0	0	2.61714
680	0	78.3	0.0409	0.0159	0	0	0	0	1.24497
690	0	69.7	0.0199	0.0077	0	0	0	0	0.53669
700	0	71.6	0.0096	0.0037	0	0	0	0	0.26492
710	0	74.3	0.0046	0.0018	0	0	0	0	0.13374
720	0	61.6	0.0022	0.0008	0	0	0	0	0.04928
730	0	69.9	0.001	0.0004	0	0	0	0	0.02796
740	0	75.1	0.0005	0.0002	0	0	0	0	0.01502
750	0	63.6	0.0003	0.0001	0	0	0	0	0.00636
760	0	46.4	0.0001	0	0	0	0	0	0
770	0	66.8	0.0001	0	0	0	0	0	0
780	0	63.4	0	0	0	0	0	0	0
					Sum of	589.3715	896.6867	47.46999	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						50.71916	77.16559	4.085094	
						L*=	a*=	b*=	
						90.40	(52.50)	116.20	

Table 19: The L* a* b* values of the ideal blue ink

Wavelen...	O	S	x	y	z	S*O*x	S*O*y	S*A*z	S*y
380	1	50	0.0002	0	0.0007	0.01	0	0.035	0
390	1	54.6	0.0024	0.0003	0.0105	0.13104	0.01638	0.5733	0.01638
400	1	82.8	0.0191	0.002	0.086	1.58148	0.1656	7.1208	0.1656
410	1	91.5	0.0847	0.0088	0.3894	7.75005	0.8052	35.6301	0.8052
420	1	93.4	0.2045	0.0214	0.9725	19.1003	1.99876	90.8315	1.99876
430	1	86.7	0.3147	0.0387	1.5535	27.28449	3.35529	134.6884	3.35529
440	1	104.9	0.3837	0.0621	1.9673	40.25013	6.51429	206.3698	6.51429
450	1	117	0.3707	0.0895	1.9948	43.3719	10.4715	233.3916	10.4715
460	1	117.8	0.3023	0.1282	1.7454	35.61094	15.10196	205.6081	15.10196
470	1	114.9	0.1956	0.1852	0.3176	22.47444	21.27948	36.49224	21.27948
480	1	115.9	0.0805	0.2536	0.7721	9.32995	29.39224	89.48639	29.39224
490	1	108.8	0.0162	0.3391	0.4153	1.76256	36.89408	45.18464	36.89408
500	1	109.4	0.0038	0.4608	0.2185	0.41572	50.41152	23.9039	50.41152
510	0	107.8	0.0375	0.6067	0.112	0	0	0	65.40226
520	0	104.8	0.1177	0.7618	0.0607	0	0	0	79.83664
530	0	107.7	0.2365	0.8752	0.0305	0	0	0	94.25904
540	0	104.4	0.3768	0.962	0.0137	0	0	0	100.4328
550	0	104	0.5298	0.9918	0.004	0	0	0	103.1472
560	0	100	0.7052	0.9973	0	0	0	0	99.73
570	0	96.3	0.8787	0.9556	0	0	0	0	92.02428
580	0	95.8	1.0142	0.8689	0	0	0	0	83.24062
590	0	88.7	1.1185	0.7774	0	0	0	0	68.95538
600	0	90	1.124	0.6583	0	0	0	0	59.247
610	0	89.6	1.0305	0.528	0	0	0	0	47.3088
620	0	87.7	0.8563	0.3981	0	0	0	0	34.91337
630	0	83.3	0.6475	0.2835	0	0	0	0	23.61555
640	0	83.7	0.4316	0.1798	0	0	0	0	15.04926
650	0	80	0.2683	0.1076	0	0	0	0	8.608
660	0	82.2	0.1526	0.0603	0	0	0	0	4.95666
670	0	82.3	0.0813	0.0318	0	0	0	0	2.61714
680	0	78.3	0.0409	0.0159	0	0	0	0	1.24497
690	0	69.7	0.0199	0.0077	0	0	0	0	0.53669
700	0	71.6	0.0096	0.0037	0	0	0	0	0.26492
710	0	74.3	0.0046	0.0018	0	0	0	0	0.13374
720	0	61.6	0.0022	0.0008	0	0	0	0	0.04928
730	0	69.9	0.001	0.0004	0	0	0	0	0.02796
740	0	75.1	0.0005	0.0002	0	0	0	0	0.01502
750	0	63.6	0.0003	0.0001	0	0	0	0	0.00636
760	0	46.4	0.0001	0	0	0	0	0	0
770	0	66.8	0.0001	0	0	0	0	0	0
780	0	63.4	0	0	0	0	0	0	0
					Sum of	209.073	176.4063	1109.316	1162.029
					K-factor	0.086056			
						X VAL...	Y VAL...	Z VALUE =	
						17.99206	15.18088	95.46367	
						L*=	a*=	b*=	
						45.88	105.00	(85.80)	

APPENDIX B

The L* a* b* Measured from the 30 Samples of Each Ink Sequence

Table 20: The L* a* b* measured from the cyan, magenta, yellow, red, green, and blue patches from the 30 samples of the YMCK sequence

	CYAN			MAGENTA			YELLOW			RED			GREEN			BLUE	
L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
60.40	(33.49)	(37.30)	49.88	59.23	(11.23)	84.16	(5.82)	96.25	52.57	43.68	57.10	55.64	(57.11)	34.47	32.14	19.06	(39.50)
61.56	(33.42)	(36.31)	49.61	59.67	(11.27)	84.50	(6.02)	97.08	53.05	42.89	58.06	55.81	(57.00)	34.55	31.80	18.43	(39.81)
60.80	(33.59)	(37.02)	50.14	58.97	(11.47)	84.08	(5.70)	96.80	52.60	43.97	57.36	55.76	(57.32)	33.95	32.53	19.26	(39.30)
60.88	(33.65)	(36.94)	50.35	58.62	(11.92)	84.68	(6.30)	97.19	53.90	41.65	58.81	55.77	(57.62)	34.73	32.43	19.53	(39.48)
61.90	(33.30)	(35.87)	50.30	58.69	(11.76)	84.69	(6.18)	97.16	53.65	41.79	58.17	56.38	(56.62)	35.04	32.99	20.23	(38.79)
61.26	(33.60)	(36.69)	50.11	58.70	(11.68)	84.29	(5.59)	96.84	53.01	42.79	56.90	55.72	(57.46)	34.87	31.92	18.98	(39.80)
61.54	(33.38)	(36.34)	50.14	58.78	(11.71)	84.64	(6.09)	96.32	53.75	41.60	58.07	56.03	(56.88)	34.36	32.93	19.99	(38.92)
61.46	(33.31)	(36.37)	50.47	58.65	(11.83)	84.06	(5.84)	96.27	53.81	41.53	58.33	55.77	(57.20)	33.69	32.86	18.97	(39.52)
61.82	(33.31)	(36.07)	50.47	58.53	(11.99)	84.67	(5.95)	97.42	53.46	42.31	58.02	56.00	(57.06)	34.38	32.87	19.06	(39.49)
61.61	(33.35)	(36.34)	50.32	58.43	(11.88)	84.37	(5.78)	97.36	53.01	42.85	57.18	55.80	(57.27)	34.70	32.72	18.99	(39.39)
62.00	(33.26)	(35.94)	50.17	58.84	(11.82)	84.60	(6.02)	96.57	53.49	42.19	57.92	56.05	(56.87)	35.53	32.60	19.39	(39.56)
61.19	(33.44)	(36.80)	50.48	58.63	(11.81)	84.75	(6.09)	96.62	53.38	42.37	57.28	55.95	(57.08)	35.13	32.39	19.42	(39.42)
61.40	(33.50)	(36.62)	50.06	59.25	(11.60)	83.93	(5.32)	95.73	53.62	41.93	58.54	56.28	(56.78)	34.67	33.01	19.82	(39.19)
60.87	(33.64)	(37.09)	50.87	57.78	(12.24)	84.24	(5.50)	97.03	53.73	41.83	58.70	55.69	(57.59)	34.33	32.79	18.85	(39.71)
61.51	(33.36)	(36.52)	50.69	58.03	(12.39)	84.11	(5.54)	97.12	53.27	42.60	57.80	55.88	(57.22)	34.42	32.73	18.77	(39.52)
60.70	(33.57)	(37.24)	50.43	58.33	(11.93)	84.30	(5.58)	97.95	53.86	41.43	58.64	55.94	(56.98)	34.32	32.76	18.88	(39.54)
60.76	(33.50)	(37.12)	50.23	58.82	(11.84)	84.66	(6.06)	98.16	53.22	42.57	58.41	55.73	(57.27)	34.44	32.69	18.45	(39.67)
61.56	(33.40)	(36.49)	50.25	58.87	(11.74)	84.58	(5.70)	97.75	53.86	41.78	58.60	56.08	(57.14)	34.89	32.85	19.57	(39.24)
61.31	(33.38)	(36.66)	49.76	59.64	(11.33)	84.05	(5.34)	96.53	53.18	42.83	57.50	55.99	(56.68)	35.24	32.28	19.11	(39.55)
61.85	(33.23)	(36.20)	50.19	59.01	(11.69)	84.25	(5.44)	97.23	53.13	42.73	57.56	56.22	(56.61)	36.16	32.30	19.00	(39.66)
61.39	(33.34)	(36.69)	49.78	59.35	(11.49)	84.32	(5.57)	96.19	53.03	43.11	57.70	56.05	(56.92)	35.64	32.14	18.83	(39.77)
60.55	(33.65)	(37.43)	49.69	59.41	(11.61)	83.99	(4.91)	97.29	53.26	42.63	58.35	55.46	(58.01)	34.68	32.03	19.45	(39.42)
61.48	(33.49)	(36.45)	50.09	58.81	(11.84)	84.42	(5.91)	96.14	53.15	42.62	58.47	56.07	(56.88)	34.79	32.37	19.69	(39.32)
61.30	(33.31)	(36.61)	49.93	59.10	(11.63)	84.38	(5.46)	97.15	53.10	42.75	58.11	55.64	(57.26)	35.41	32.21	19.57	(39.53)
61.27	(33.33)	(36.73)	49.81	59.17	(11.85)	83.87	(4.74)	97.77	52.93	43.57	58.25	55.55	(57.96)	36.30	32.10	19.84	(39.33)
59.93	(33.30)	(37.09)	48.99	58.72	(11.52)	83.15	(5.40)	95.77	52.70	41.97	57.88	55.34	(56.35)	35.88	31.44	20.43	(38.91)
60.07	(33.13)	(36.92)	48.93	58.95	(11.48)	83.31	(5.73)	96.03	52.82	41.38	58.04	55.17	(56.43)	35.17	31.55	19.44	(39.28)
60.69	(33.07)	(36.34)	48.75	59.03	(11.48)	83.07	(5.64)	95.95	52.13	42.89	57.26	55.34	(56.51)	35.35	31.16	20.35	(39.22)
60.20	(33.20)	(36.91)	49.00	58.87	(11.60)	82.73	(4.87)	95.07	52.23	42.54	56.56	54.91	(57.25)	35.30	31.18	19.83	(39.38)
60.31	(33.17)	(36.89)	48.87	58.82	(11.36)	83.59	(5.98)	95.33	52.06	42.82	56.97	54.69	(57.20)	34.77	31.33	19.14	(39.50)
Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =	Mean =
61.12	(33.39)	(36.67)	49.96	58.86	(11.70)	84.15	(5.67)	96.74	53.17	42.45	57.88	55.76	(57.08)	34.91	32.30	19.34	(39.42)
STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =	STD =
0.76	0.40	0.64	0.75	0.65	0.52	0.73	0.62	0.88	0.72	0.83	0.78	0.62	0.64	0.79	0.75	0.73	0.50

Table 21: The L* a* b* measured from the cyan, magenta, yellow, red, green, and blue patches from the 30 samples of the YCMK sequence

	CYAN			MAGENTA			YELLOW			RED			GREEN			BLUE	
L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
60.37	(34.79)	(36.67)	48.65	60.38	(10.57)	83.76	(8.77)	95.14	49.72	46.10	54.81	56.70	(56.47)	37.50	32.15	10.63	(40.97)
60.59	(34.75)	(36.31)	48.84	60.23	(10.65)	83.84	(8.24)	96.82	49.48	46.85	55.59	56.44	(56.54)	38.69	33.63	11.03	(40.89)
60.32	(34.90)	(36.90)	48.64	60.22	(10.74)	83.84	(8.14)	97.07	49.80	45.97	55.77	56.18	(57.45)	36.20	32.03	10.11	(41.15)
60.79	(34.68)	(36.24)	48.63	59.48	(11.27)	83.85	(8.05)	96.94	49.55	46.68	55.00	56.52	(56.90)	37.28	31.87	10.92	(41.00)
60.91	(34.71)	(36.14)	48.73	60.07	(10.79)	84.00	(7.89)	97.44	49.05	47.55	54.72	56.59	(56.81)	38.37	32.04	11.11	(41.05)
60.36	(34.88)	(36.75)	48.81	60.02	(10.83)	84.01	(7.83)	97.51	49.71	46.63	55.68	56.56	(57.07)	37.83	32.16	10.69	(40.95)
60.65	(34.67)	(36.40)	48.83	58.80	(11.48)	84.00	(7.77)	97.79	49.84	46.28	55.48	56.81	(56.52)	38.41	32.27	10.93	(40.94)
60.69	(34.77)	(36.38)	49.09	59.53	(11.08)	84.06	(7.86)	97.20	49.86	46.31	55.75	56.66	(56.47)	38.18	32.01	11.00	(40.89)
60.74	(34.70)	(36.31)	48.28	60.29	(10.71)	83.89	(7.96)	96.84	49.64	46.71	55.80	56.96	(55.95)	40.00	31.79	10.85	(41.02)
60.51	(34.65)	(36.48)	48.28	60.62	(10.52)	83.91	(7.93)	97.13	48.60	46.79	55.08	56.47	(56.84)	37.62	31.90	11.16	(40.90)
60.54	(34.82)	(36.29)	48.71	59.93	(11.01)	83.77	(8.32)	96.33	49.77	46.62	55.21	56.18	(57.40)	36.00	32.15	10.64	(40.92)
60.73	(34.89)	(36.30)	48.66	59.97	(11.18)	84.03	(8.21)	97.14	49.91	46.10	55.89	56.76	(56.56)	39.14	32.02	10.99	(41.06)
60.87	(34.81)	(36.14)	48.72	59.88	(10.94)	84.07	(8.00)	97.28	49.47	46.88	55.20	56.72	(56.48)	38.17	32.09	10.25	(41.10)
60.93	(34.92)	(36.43)	48.60	60.05	(10.89)	84.14	(7.86)	97.65	49.51	46.68	54.73	56.63	(56.92)	38.46	32.12	10.83	(41.08)
60.79	(34.94)	(36.28)	48.71	59.71	(11.17)	84.01	(8.00)	97.02	49.71	46.43	55.69	56.44	(57.10)	37.33	32.74	9.36	(41.10)
60.48	(34.94)	(36.78)	48.78	59.75	(11.06)	84.16	(7.79)	97.63	49.89	45.87	55.73	56.86	(56.48)	37.80	32.77	9.78	(41.00)
60.95	(34.80)	(36.01)	48.94	59.69	(11.06)	84.08	(8.01)	97.17	49.53	46.99	54.80	56.85	(56.40)	38.32	32.72	9.85	(41.03)
61.10	(34.80)	(35.99)	48.91	60.06	(10.91)	84.09	(8.30)	96.68	49.56	46.59	54.96	56.53	(57.52)	37.53	32.21	10.45	(41.01)
60.72	(34.82)	(36.52)	48.85	59.95	(10.83)	84.08	(8.04)	97.23	49.65	46.82	55.28	56.50	(57.12)	36.72	32.70	9.79	(41.03)
60.74	(35.00)	(36.50)	48.96	59.62	(11.24)	84.17	(7.88)	97.54	49.87	46.29	55.86	56.62	(57.06)	37.90	32.32	10.16	(41.20)
60.77	(34.89)	(36.28)	49.04	59.78	(11.12)	84.25	(7.91)	97.57	49.83	45.69	55.14	56.73	(56.81)	37.27	32.63	9.49	(41.25)
60.64	(34.80)	(36.33)	49.14	59.30	(11.31)	83.96	(8.23)	97.01	49.70	46.39	55.06	56.66	(56.40)	38.24	32.27	10.61	(40.87)
60.86	(34.93)	(36.35)	48.93	59.18	(11.44)	83.92	(8.30)	96.80	49.55	46.07	54.81	56.41	(57.20)	36.98	32.47	10.00	(41.07)
60.78	(34.79)	(36.35)	48.98	59.85	(10.96)	83.82	(8.48)	96.63	49.70	45.74	55.06	56.78	(56.75)	38.31	32.28	10.22	(40.98)
61.00	(34.78)	(36.00)	49.00	59.22	(11.54)	83.76	(8.42)	96.80	49.97	45.86	55.60	56.97	(56.37)	38.41	32.49	10.25	(41.15)
61.30	(34.76)	(35.76)	48.82	59.79	(11.02)	83.95	(8.13)	96.84	49.54	46.27	54.91	57.28	(55.94)	37.79	32.11	10.96	(40.91)
60.98	(34.95)	(36.15)	48.91	59.26	(11.55)	84.03	(8.07)	97.20	50.13	45.69	55.63	56.69	(57.10)	36.31	32.27	10.87	(41.09)
60.91	(35.14)	(36.31)	48.85	59.64	(11.41)	84.19	(7.87)	97.56	50.17	45.78	56.04	56.39	(57.64)	36.37	32.48	10.33	(41.18)
60.52	(35.04)	(36.92)	48.81	59.68	(11.34)	84.13	(8.09)	96.86	50.08	45.28	55.01	56.59	(57.36)	36.28	32.72	10.53	(40.95)
60.82	(34.88)	(36.42)	48.94	59.14	(11.57)	83.78	(8.62)	95.73	50.17	45.16	55.43	56.77	(56.58)	37.36	33.07	9.94	(40.92)
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
60.75	(34.84)	(36.36)	48.80	59.77	(11.07)	83.98	(8.10)	97.02	49.70	46.30	55.32	56.64	(56.81)	37.69	32.35	10.46	(41.02)
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.22	0.11	0.26	0.20	0.41	0.30	0.14	0.25	0.56	0.32	0.53	0.40	0.25	0.44	0.93	0.39	0.50	0.10

Table 22: The L* a* b* measured from the cyan, magenta, yellow, red, green, and blue patches from the 30 samples of the CYMK sequence

	CYAN			MAGENTA			YELLOW			RED			GREEN			BLUE	
L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
61.31	(34.74)	(37.05)	49.85	60.73	(10.89)	84.98	(6.89)	96.18	48.43	53.40	48.46	54.54	(59.66)	29.71	32.86	12.48	(41.64)
61.00	(34.96)	(37.24)	49.41	61.59	(10.52)	85.21	(6.65)	96.40	48.22	53.95	48.77	54.38	(60.00)	31.01	32.32	13.49	(41.72)
61.18	(34.83)	(37.17)	49.28	61.43	(10.52)	85.14	(6.68)	96.68	48.20	53.87	49.16	54.35	(59.87)	31.26	32.13	13.29	(41.73)
61.15	(34.86)	(37.20)	49.66	61.03	(10.66)	85.34	(6.62)	95.45	48.65	53.54	48.27	54.41	(59.96)	29.14	32.59	12.62	(41.60)
61.11	(34.91)	(37.23)	49.90	60.77	(11.02)	85.19	(6.56)	95.77	48.42	53.44	48.05	54.38	(59.87)	29.56	32.85	12.77	(41.66)
61.06	(34.89)	(37.44)	49.77	60.73	(10.87)	85.39	(6.55)	95.29	48.70	53.67	48.96	54.20	(60.09)	27.94	32.49	12.04	(42.04)
60.82	(34.94)	(37.58)	50.01	60.49	(10.98)	85.37	(6.44)	96.43	47.87	54.29	48.35	54.34	(59.92)	30.14	32.13	13.22	(41.93)
60.75	(34.70)	(37.14)	49.85	60.58	(10.86)	85.17	(6.29)	95.92	48.42	53.58	48.49	53.93	(59.68)	27.57	33.06	12.03	(41.49)
60.84	(34.76)	(37.14)	49.74	60.77	(10.86)	85.04	(6.53)	95.99	48.15	53.77	48.82	54.00	(59.63)	29.70	33.02	11.54	(41.63)
60.82	(34.87)	(37.23)	50.28	59.65	(11.44)	85.07	(6.56)	95.21	48.44	53.39	47.76	54.00	(59.55)	28.43	33.41	11.24	(41.78)
60.79	(35.00)	(37.23)	49.90	60.10	(11.33)	84.85	(6.42)	95.95	48.27	53.39	48.30	54.13	(59.77)	29.57	32.71	12.73	(41.56)
60.92	(34.86)	(37.13)	50.34	59.79	(11.38)	85.01	(6.79)	95.03	48.65	52.85	48.33	54.33	(59.58)	28.42	32.85	12.19	(41.65)
61.00	(34.98)	(37.14)	49.63	60.84	(10.92)	85.20	(6.38)	93.29	48.62	53.19	48.60	54.19	(59.58)	27.53	33.30	11.60	(41.68)
60.95	(34.86)	(37.14)	49.70	60.59	(11.08)	85.09	(6.56)	95.70	48.67	53.14	48.23	54.22	(56.52)	27.57	33.26	11.43	(41.84)
61.04	(34.80)	(37.05)	49.49	60.95	(10.74)	84.78	(6.98)	95.33	48.00	53.58	47.85	54.13	(59.80)	27.07	32.49	12.71	(41.74)
60.76	(34.86)	(37.27)	49.44	60.99	(10.68)	84.81	(6.92)	95.20	47.97	53.69	47.46	54.17	(59.57)	28.67	32.30	12.74	(41.79)
60.82	(34.97)	(37.33)	48.73	61.88	(10.18)	85.07	(6.41)	96.04	47.88	54.08	48.20	53.80	(59.89)	30.21	31.61	13.33	(41.77)
60.93	(34.94)	(37.17)	48.99	61.57	(10.32)	84.92	(6.85)	95.27	48.08	53.45	47.05	54.14	(59.71)	28.51	32.06	13.10	(41.57)
60.78	(35.02)	(37.41)	48.95	61.72	(10.31)	85.00	(6.73)	96.16	47.98	53.74	48.71	53.89	(60.19)	29.44	31.82	13.47	(41.68)
60.85	(34.87)	(37.18)	49.19	60.97	(10.77)	85.10	(6.50)	95.13	47.97	53.83	47.44	54.04	(60.12)	29.80	32.06	13.06	(41.61)
61.15	(34.67)	(36.91)	49.47	60.71	(10.79)	84.69	(6.63)	95.96	47.77	54.15	48.26	54.02	(60.04)	31.41	32.09	13.19	(41.48)
61.01	(34.85)	(37.05)	49.24	61.02	(10.74)	84.96	(6.55)	96.38	47.63	54.47	48.10	53.93	(59.66)	29.54	32.17	13.14	(41.60)
61.05	(34.79)	(36.88)	49.53	60.73	(10.70)	85.01	(6.37)	95.15	48.09	53.86	47.55	53.99	(59.74)	28.80	32.21	13.11	(41.65)
60.88	(34.83)	(37.13)	48.99	61.09	(10.55)	84.89	(6.71)	95.97	47.71	54.37	48.58	53.92	(59.95)	39.36	31.47	14.30	(41.39)
60.91	(34.90)	(37.11)	49.06	61.51	(10.26)	84.94	(6.80)	95.42	47.54	54.31	47.00	54.00	(59.85)	28.73	31.67	13.64	(41.49)
60.83	(34.93)	(37.22)	49.07	61.63	(10.43)	85.13	(6.45)	95.54	47.97	53.99	47.59	54.08	(59.63)	28.20	32.19	13.22	(41.52)
60.96	(34.83)	(37.08)	49.42	61.09	(10.59)	84.83	(6.82)	95.54	47.49	54.38	47.60	54.04	(60.02)	29.52	32.10	13.42	(41.43)
61.10	(34.84)	(36.99)	49.81	60.69	(10.85)	84.84	(6.89)	95.20	48.14	54.12	47.20	54.21	(60.02)	28.48	32.86	12.19	(41.79)
60.76	(34.84)	(37.28)	49.79	60.49	(11.11)	85.11	(6.28)	96.20	48.31	53.77	48.12	54.07	(59.56)	28.32	32.69	11.95	(41.92)
60.69	(30.00)	(37.43)	49.99	60.25	(11.11)	84.83	(6.64)	96.44	48.14	53.38	47.91	54.00	(59.92)	29.87	33.18	10.94	(41.94)
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
60.94	(34.70)	(37.19)	49.55	60.88	(10.78)	85.03	(6.61)	95.67	48.15	53.75	48.11	54.13	(59.71)	29.45	32.46	12.67	(41.68)
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.15	0.89	0.15	0.40	0.54	0.32	0.18	0.19	0.65	0.34	0.40	0.56	0.18	0.63	2.17	0.53	0.80	0.16

Table 23: The L* a* b* measured from the cyan, magenta, yellow, red, green, and blue patches from the 30 samples of the KCMY sequence

	CYAN			MAGENTA			YELLOW			RED			GREEN			BLUE	
L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
61.12	(34.61)	(36.61)	50.05	59.79	(11.27)	85.12	(6.93)	94.89	48.16	53.07	45.76	54.76	(59.06)	25.47	33.53	11.89	(41.09)
60.59	(34.78)	(37.08)	49.69	60.15	(11.39)	84.56	(6.39)	93.12	48.23	52.90	46.34	54.86	(58.73)	26.57	33.94	11.66	(40.99)
61.38	(34.76)	(36.40)	50.12	59.99	(11.51)	84.74	(6.44)	94.40	48.69	52.15	45.56	54.88	(59.19)	26.95	34.39	10.70	(41.09)
61.38	(34.64)	(36.31)	50.21	59.62	(11.75)	84.90	(6.56)	93.39	48.60	52.48	45.83	54.87	(59.00)	26.96	33.78	11.32	(41.07)
60.70	(34.79)	(36.97)	50.11	59.46	(11.64)	84.82	(6.56)	94.26	48.85	52.01	46.33	54.75	(59.11)	26.03	34.00	11.10	(41.10)
61.00	(34.93)	(36.79)	50.07	59.93	(11.57)	85.18	(6.87)	95.00	48.74	52.56	45.20	54.71	(59.39)	25.56	34.17	10.69	(41.25)
60.86	(34.88)	(36.97)	50.19	59.84	(11.65)	85.10	(6.92)	92.62	48.66	52.65	46.17	54.75	(59.15)	28.41	34.37	11.40	(41.09)
60.72	(34.81)	(36.99)	49.97	59.95	(11.62)	84.59	(6.48)	94.38	48.73	52.33	46.09	54.81	(59.07)	27.90	33.60	10.99	(41.35)
60.90	(34.86)	(36.87)	50.34	59.69	(11.61)	85.07	(6.92)	94.61	48.55	52.51	45.84	54.79	(59.21)	25.35	33.94	11.12	(41.35)
60.68	(34.87)	(37.08)	50.17	59.60	(11.73)	84.99	(6.77)	94.07	48.70	52.26	45.57	54.53	(59.59)	26.64	34.04	10.59	(41.39)
61.24	(34.86)	(36.56)	50.35	59.42	(11.90)	84.65	(6.49)	93.82	48.71	52.31	46.13	54.59	(59.28)	27.47	34.55	9.32	(41.58)
60.98	(34.87)	(36.76)	50.37	59.20	(11.85)	84.63	(6.52)	94.84	48.72	52.17	46.35	54.83	(59.16)	26.92	34.56	11.14	(41.01)
61.09	(34.89)	(36.72)	49.84	60.10	(11.46)	84.96	(6.81)	94.92	48.55	52.49	45.83	54.90	(59.95)	25.14	34.49	11.06	(41.01)
60.96	(34.95)	(36.83)	50.06	59.94	(11.68)	85.25	(7.03)	93.77	48.57	52.21	45.71	54.66	(59.52)	25.85	34.49	9.86	(41.40)
60.97	(34.87)	(36.75)	50.26	59.44	(11.78)	85.05	(7.07)	93.77	48.67	52.29	45.59	54.88	(58.92)	26.94	34.82	10.02	(41.25)
60.74	(35.01)	(37.15)	50.08	59.81	(11.66)	85.31	(6.98)	94.62	48.68	52.27	46.37	54.94	(58.95)	26.92	33.74	11.55	(41.19)
60.67	(34.90)	(37.06)	49.88	59.96	(11.60)	84.87	(6.84)	95.06	48.53	51.95	46.59	54.78	(58.94)	26.78	33.80	10.52	(41.29)
61.67	(34.62)	(36.05)	50.47	59.14	(11.88)	84.57	(6.27)	93.34	48.53	52.72	46.31	54.88	(59.19)	27.91	34.14	9.92	(41.45)
61.21	(34.86)	(36.58)	50.12	59.53	(11.70)	85.23	(6.94)	93.63	48.77	52.24	45.82	54.50	(59.59)	27.50	34.01	11.27	(41.32)
60.67	(34.78)	(37.13)	50.56	59.34	(11.80)	85.12	(6.84)	94.52	48.74	52.28	46.53	54.61	(59.40)	25.28	34.14	10.87	(41.33)
61.08	(34.87)	(36.77)	49.99	59.94	(11.55)	85.11	(6.81)	92.92	48.61	52.57	45.37	54.65	(59.41)	25.93	34.53	10.89	(41.31)
60.90	(34.79)	(36.93)	50.14	59.68	(11.66)	85.00	(6.69)	92.85	48.71	52.17	45.97	54.55	(59.38)	26.81	33.82	11.12	(41.42)
60.91	(34.87)	(34.87)	50.39	59.30	(11.84)	84.95	(6.75)	94.15	48.57	52.56	46.42	54.78	(59.11)	26.28	34.06	12.27	(40.87)
61.44	(34.77)	(34.77)	50.16	59.70	(11.78)	85.03	(6.85)	94.41	48.44	52.43	44.94	54.79	(59.14)	25.50	34.76	9.82	(41.26)
60.94	(34.88)	(34.88)	50.38	59.47	(11.80)	85.21	(6.93)	93.48	48.78	52.00	44.91	54.71	(59.15)	26.12	34.02	10.34	(41.42)
60.99	(34.82)	(34.82)	50.30	59.55	(11.86)	85.22	(6.86)	94.07	48.49	52.71	45.13	55.06	(59.02)	26.11	33.98	11.61	(41.15)
61.01	(34.60)	(34.60)	50.07	59.58	(11.56)	85.06	(7.02)	93.72	48.56	52.23	45.21	54.64	(59.02)	27.41	34.22	10.93	(41.11)
60.61	(34.86)	(34.86)	50.30	59.44	(11.71)	85.11	(6.96)	93.53	48.83	51.89	45.28	54.51	(59.24)	27.06	34.77	10.57	(41.24)
60.94	(34.80)	(34.80)	50.37	59.35	(11.96)	84.55	(6.22)	92.52	48.63	52.51	45.67	54.81	(59.02)	25.95	34.03	10.81	(41.24)
60.73	(34.92)	(34.92)	50.28	59.52	(11.79)	84.76	(6.49)	94.73	48.72	52.38	45.57	54.83	(59.14)	27.63	34.05	10.62	(41.29)
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
60.97	(34.82)	(36.26)	50.18	59.65	(11.69)	84.96	(6.74)	93.98	48.62	52.38	45.81	54.75	(59.20)	26.58	34.16	10.87	(41.23)
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.32	0.32	0.97	0.44	0.52	0.40	0.49	0.49	0.86	0.40	0.53	0.70	0.37	0.50	0.94	0.59	0.82	0.41

APPENDIX C

The Color Differences between the Colors: Cyan, Magenta, Yellow, Red, Green, and Blue of the Process Inks and Those of the Ideal Inks Calculated for the Four Ink Sequences

Table 24: The color difference values calculated for the YMCK sequence

DELT... CYAN	DELT... MAG...	DELT... YELL...	DELT... RED	DELT... GREEN	DELTA E BLUE
49.66	46.92	30.54	65.40	88.93	98.58
48.14	46.88	29.63	65.10	88.79	99.03
49.19	46.68	30.13	65.03	89.38	98.45
49.08	46.27	29.38	65.29	88.67	98.14
47.58	46.42	29.44	65.70	88.10	97.79
48.63	46.55	30.05	66.10	88.55	98.54
48.17	46.49	30.22	65.90	88.87	97.94
48.25	46.31	30.56	65.74	89.61	98.55
47.78	46.19	29.29	65.50	88.87	98.49
48.12	46.36	29.51	65.84	88.67	98.61
47.56	46.37	30.04	65.65	87.79	98.20
48.75	46.33	29.92	66.06	88.21	98.27
48.48	46.52	31.24	65.32	88.49	97.95
49.19	46.01	29.93	65.26	89.07	98.58
48.32	45.87	29.89	65.50	88.89	98.74
49.41	46.30	29.09	65.55	88.95	98.63
49.28	46.34	28.61	65.01	88.94	98.96
48.27	46.41	29.11	65.38	88.38	98.16
48.56	46.79	30.49	65.60	88.07	98.49
47.85	46.45	29.77	65.60	87.13	98.54
48.53	46.69	30.61	65.27	87.69	98.66
49.66	46.59	30.00	65.03	88.86	98.29
48.30	46.38	30.52	64.93	88.46	98.09
48.53	46.56	29.79	65.14	88.08	98.11
48.64	46.38	29.69	64.55	87.34	97.99
49.83	47.03	31.48	65.76	87.72	97.77
49.60	47.03	31.09	65.98	88.44	98.44
48.75	47.07	31.28	65.69	88.22	97.73
49.51	46.92	32.42	66.47	88.47	98.11
49.41	47.19	31.52	65.97	89.04	98.63
Mean =	Mean =	Mean =	Mean =	Mean =	Mean =
48.70	46.54	30.17	65.51	88.49	98.35
STD =	STD =	STD =	STD =	STD =	STD =
0.82	0.57	0.93	0.65	0.76	0.59

Table 25: The color difference values calculated for the YCMK sequence

DELTA CYAN	DELTA MAG...	DELTA YELL...	DELTA RED	DELTA GREEN	DELTA BLUE
49.34	47.70	30.94	65.89	85.70	105.38
48.93	47.59	29.52	64.83	84.72	104.87
49.55	47.57	29.32	65.14	87.15	105.78
48.73	47.22	29.46	65.42	86.00	105.14
48.58	47.52	28.99	65.21	84.97	104.93
49.41	47.47	28.94	64.87	85.49	105.33
48.94	47.10	28.71	65.23	84.83	105.10
48.91	47.24	29.19	64.98	85.10	105.10
48.82	47.70	29.55	64.72	83.29	105.20
49.10	47.82	29.29	65.29	85.70	104.96
48.96	47.35	29.97	65.28	87.33	105.39
48.84	47.20	29.17	64.97	84.18	105.03
48.62	47.42	29.08	65.15	85.08	105.67
48.79	47.47	28.76	65.65	84.87	105.15
48.79	47.24	29.33	64.97	85.99	106.38
49.36	47.31	28.79	65.23	85.37	106.05
48.47	47.28	29.17	65.43	84.89	105.98
48.35	47.36	29.54	65.50	85.80	105.51
48.99	47.47	29.11	65.11	86.53	106.03
48.98	47.12	28.84	64.90	85.40	105.68
48.80	47.17	28.77	65.83	85.92	106.22
48.91	47.06	29.31	65.52	85.04	105.42
48.79	47.02	29.50	65.90	86.33	105.86
48.83	47.33	29.65	65.86	84.94	105.72
48.43	46.90	29.53	65.35	84.76	105.60
48.04	47.33	29.49	65.71	85.19	105.11
48.56	46.91	29.15	65.42	86.83	105.09
48.74	46.99	28.82	65.02	86.92	105.51
49.44	47.06	29.41	66.16	86.91	105.40
48.86	46.91	30.44	65.87	85.81	105.90
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
48.86	47.29	29.32	65.35	85.57	105.48
STD=	STD=	STD=	STD=	STD=	STD=
0.33	0.25	0.49	0.38	0.92	0.41

Table 26: The color difference values calculated for the CMYK sequence

DELTA CYAN	DELTA MAG...	DELTA YELL...	DELTA RED	DELTA GREEN	DELTA BLUE
48.76	46.73	31.10	70.76	97.70	104.02
49.48	46.66	33.99	70.30	96.62	104.23
48.44	46.45	35.04	71.31	96.29	104.99
48.37	46.26	34.06	70.93	96.27	104.51
49.32	46.43	34.85	70.66	97.19	104.67
49.00	46.42	35.29	71.48	97.66	104.96
49.22	46.32	33.19	70.55	94.99	104.37
49.32	46.39	35.05	70.75	95.43	104.71
49.12	46.35	34.95	70.91	97.81	104.56
49.42	46.30	34.55	71.26	96.74	105.00
48.66	46.12	34.53	70.72	95.92	106.01
48.99	46.21	35.42	70.58	96.34	104.61
48.88	46.55	35.30	70.93	98.02	104.69
49.06	46.31	34.12	71.15	97.42	105.61
48.99	46.26	34.16	71.23	96.28	105.49
49.44	46.35	34.87	70.52	96.28	104.26
49.42	46.44	35.44	70.44	96.47	105.14
47.98	46.16	34.22	70.39	95.40	105.57
48.70	46.36	34.03	71.03	95.95	104.43
49.46	46.17	34.89	70.37	97.95	104.77
48.92	46.46	33.49	71.32	97.34	104.71
49.15	46.36	33.51	70.92	96.56	104.54
47.71	46.19	34.64	70.36	96.94	103.72
47.25	46.24	34.81	71.77	97.67	105.67
47.70	46.20	33.91	71.97	97.12	105.22
47.62	46.15	34.45	71.48	96.99	104.20
47.43	46.49	34.13	71.60	95.94	104.80
47.92	46.31	33.97	71.67	96.33	105.01
47.64	46.07	33.54	71.06	97.23	104.87
47.88	46.23	35.30	71.21	95.68	105.02
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
48.64	46.33	34.36	70.99	96.68	104.81
STD=	STD=	STD=	STD=	STD=	STD=
0.85	0.39	0.95	0.68	0.91	0.73

Table 27: The color difference values calculated for the KCMY sequence

DELT... CYAN	DELT... MAG...	DELT... YELL...	DELT... RED	DELT... GREEN	DELTA E BLUE
48.95	47.88	30.00	68.15	93.90	103.00
49.32	48.21	29.79	67.65	92.80	102.13
49.13	48.29	29.55	67.32	92.57	102.33
49.18	48.10	30.60	68.27	94.50	102.93
49.23	47.73	30.38	68.51	94.12	102.74
49.42	47.92	30.75	67.58	95.70	103.28
49.69	47.78	29.77	67.90	93.60	102.31
49.40	47.93	30.33	68.05	96.11	103.45
49.34	47.94	30.25	67.67	94.12	103.83
49.43	47.42	30.93	68.80	95.28	103.99
49.46	47.58	30.38	68.30	94.20	102.83
49.29	47.43	31.05	68.49	95.17	103.26
49.25	47.91	32.67	68.11	96.04	103.72
49.28	47.78	30.48	68.47	95.81	103.81
49.14	48.11	30.81	68.64	96.50	102.80
49.50	48.17	30.93	68.96	95.00	102.78
49.51	48.72	30.23	68.12	93.75	102.35
49.32	48.55	30.85	69.43	95.16	102.58
49.60	48.55	30.05	67.79	94.44	102.24
49.37	48.19	31.01	68.92	94.05	102.60
48.95	48.11	30.37	68.04	92.57	102.53
49.17	48.18	29.92	68.07	94.29	102.52
49.01	48.17	31.06	68.81	94.96	102.52
49.31	48.44	30.27	67.66	85.39	101.67
49.29	48.60	30.72	69.15	95.03	102.18
49.42	48.41	30.64	68.72	95.47	102.48
49.22	48.24	30.65	68.57	94.30	102.35
49.06	47.94	30.93	69.03	95.19	103.20
49.51	47.74	30.11	68.32	95.36	103.38
49.44	47.72	29.89	68.66	93.98	104.22
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
49.31	48.06	30.51	68.34	94.31	102.87
STD=	STD=	STD=	STD=	STD=	STD=
0.18	0.34	0.59	0.52	1.96	0.63

APPENDIX D

The Densities of the 30 Samples Measured from the Yellow, Magenta, Cyan, Red, Green, Blue, Black, and White Patches Through a Red, Green, Blue, and a Visual Filter

Table 28: The red filtered densities of the YMCK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.08	0.19	1.23	0.17	1.14	1.04	1.93	0.07
0.09	0.20	1.23	0.17	1.11	1.07	1.95	0.06
0.10	0.19	1.24	0.18	1.14	1.08	1.96	0.06
0.08	0.19	1.28	0.17	1.15	1.05	1.95	0.07
0.08	0.19	1.26	0.16	1.11	1.03	1.90	0.07
0.08	0.19	1.29	0.17	1.11	1.07	1.94	0.07
0.08	0.20	1.23	0.17	1.14	1.03	1.94	0.07
0.09	0.19	1.30	0.17	1.15	1.06	1.97	0.06
0.09	0.19	1.27	0.17	1.12	1.05	1.92	0.07
0.09	0.20	1.25	0.17	1.15	1.06	1.90	0.07
0.09	0.19	1.28	0.17	1.13	1.07	1.93	0.07
0.08	0.19	1.25	0.17	1.13	1.06	1.98	0.08
0.09	0.19	1.25	0.17	1.12	1.05	1.98	0.07
0.09	0.20	1.32	0.18	1.15	1.05	1.99	0.07
0.09	0.20	1.27	0.17	1.14	1.08	1.97	0.07
0.09	0.20	1.31	0.17	1.13	1.10	1.95	0.07
0.09	0.20	1.32	0.18	1.17	1.05	1.96	0.07
0.10	0.21	1.23	0.18	1.15	1.05	1.92	0.07
0.09	0.21	1.30	0.18	1.12	1.08	1.94	0.09
0.09	0.21	1.24	0.19	1.11	1.08	1.91	0.07
0.09	0.21	1.28	0.18	1.15	1.10	1.99	0.08
0.11	0.21	1.31	0.19	1.18	1.09	1.96	0.09
0.10	0.21	1.32	0.19	1.16	1.07	1.92	0.09
0.10	0.21	1.29	0.18	1.15	1.10	1.98	0.08
0.11	0.21	1.33	0.18	1.14	1.08	1.95	0.08
0.11	0.22	1.33	0.19	1.15	1.07	1.87	0.09
0.11	0.23	1.32	0.20	1.14	1.10	1.85	0.09
0.11	0.24	1.30	0.20	1.16	1.10	1.89	0.11
0.12	0.24	1.34	0.20	1.17	1.12	1.89	0.09
0.10	0.23	1.32	0.19	1.18	1.12	1.88	0.09
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.09	0.20	1.28	0.18	1.14	1.07	1.94	0.08
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.04	0.01	0.02	0.02	0.04	0.01

Table 29: The red filtered densities (subtracted out the paper densities) of the YMCK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.01	0.12	1.16	0.10	1.07	0.97	1.86
0.03	0.14	1.17	0.11	1.05	1.01	1.89
0.04	0.13	1.18	0.12	1.08	1.02	1.90
0.01	0.12	1.21	0.10	1.08	0.98	1.88
0.01	0.12	1.19	0.09	1.04	0.96	1.83
0.01	0.12	1.22	0.10	1.04	1.00	1.87
0.01	0.13	1.16	0.10	1.07	0.96	1.87
0.03	0.13	1.24	0.11	1.09	1.00	1.91
0.02	0.12	1.20	0.10	1.05	0.98	1.85
0.02	0.13	1.18	0.10	1.08	0.99	1.83
0.02	0.12	1.21	0.10	1.06	1.00	1.86
0.00	0.11	1.17	0.09	1.05	0.98	1.90
0.02	0.12	1.18	0.10	1.05	0.98	1.91
0.02	0.13	1.25	0.11	1.08	0.98	1.92
0.02	0.13	1.20	0.10	1.07	1.01	1.90
0.02	0.13	1.24	0.10	1.06	1.03	1.88
0.02	0.13	1.25	0.11	1.10	0.98	1.89
0.03	0.14	1.16	0.11	1.08	0.98	1.85
0.00	0.12	1.21	0.09	1.03	0.99	1.85
0.02	0.14	1.17	0.12	1.04	1.01	1.84
0.01	0.13	1.20	0.10	1.07	1.02	1.91
0.02	0.12	1.22	0.10	1.09	1.00	1.87
0.01	0.12	1.23	0.10	1.07	0.98	1.83
0.02	0.13	1.21	0.10	1.07	1.02	1.90
0.03	0.13	1.25	0.10	1.06	1.00	1.87
0.02	0.13	1.24	0.10	1.06	0.98	1.78
0.02	0.14	1.23	0.11	1.05	1.01	1.76
0.00	0.13	1.19	0.09	1.05	0.99	1.78
0.03	0.15	1.25	0.11	1.08	1.03	1.80
0.01	0.14	1.23	0.10	1.09	1.03	1.79
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.02	0.13	1.21	0.10	1.07	1.00	1.86
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.03	0.01	0.02	0.02	0.04

Table 30: The green filtered densities of the YMCK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.14	1.12	0.50	0.92	0.49	1.35	2.02	0.09
0.15	1.21	0.49	0.93	0.49	1.33	2.00	0.11
0.15	1.18	0.50	0.93	0.49	1.32	2.02	0.11
0.14	1.16	0.49	0.89	0.50	1.32	1.96	0.09
0.15	1.18	0.47	0.90	0.48	1.34	1.97	0.09
0.15	1.18	0.48	0.93	0.49	1.34	1.97	0.09
0.15	1.18	0.48	0.91	0.49	1.34	1.97	0.10
0.15	1.18	0.49	0.90	0.51	1.31	2.03	0.10
0.16	1.17	0.48	0.92	0.49	1.32	1.96	0.10
0.16	1.18	0.49	0.95	0.50	1.31	1.95	0.10
0.16	1.20	0.50	0.92	0.49	1.33	1.98	0.10
0.16	1.19	0.50	0.92	0.50	1.34	1.97	0.10
0.17	1.20	0.50	0.91	0.50	1.34	2.01	0.11
0.16	1.17	0.49	0.89	0.51	1.33	1.98	0.11
0.16	1.17	0.50	0.92	0.51	1.34	1.97	0.10
0.16	1.16	0.49	0.90	0.50	1.32	1.93	0.10
0.15	1.18	0.49	0.90	0.50	1.34	2.00	0.10
0.16	1.18	0.50	0.89	0.50	1.35	1.96	0.10
0.17	1.21	0.49	0.96	0.50	1.34	1.98	0.10
0.16	1.19	0.49	0.92	0.50	1.34	1.96	0.11
0.17	1.20	0.49	0.91	0.50	1.36	2.02	0.10
0.16	1.22	0.52	0.92	0.51	1.35	2.03	0.10
0.17	1.20	0.51	0.92	0.50	1.36	1.99	0.10
0.15	1.20	0.49	0.93	0.50	1.34	2.00	0.11
0.17	1.22	0.52	0.93	0.50	1.35	1.92	0.12
0.18	1.20	0.48	0.91	0.49	1.37	1.92	0.10
0.16	1.20	0.51	0.91	0.50	1.35	1.87	0.10
0.16	1.24	0.52	0.94	0.50	1.39	1.93	0.11
0.16	1.22	0.50	0.93	0.51	1.37	1.89	0.11
0.16	1.22	0.50	0.95	0.51	1.38	1.93	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.16	1.19	0.50	0.92	0.50	1.34	1.97	0.10
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.04	0.01

Table 31: The green filtered densities (subtracted out the paper densities) of the YMCK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.05	1.03	0.41	0.83	0.40	1.26	1.93
0.04	1.10	0.38	0.82	0.38	1.22	1.89
0.04	1.07	0.39	0.82	0.38	1.21	1.91
0.05	1.07	0.40	0.80	0.41	1.23	1.87
0.06	1.09	0.38	0.81	0.39	1.25	1.88
0.06	1.09	0.39	0.84	0.40	1.25	1.88
0.05	1.08	0.38	0.81	0.39	1.24	1.87
0.05	1.08	0.39	0.80	0.41	1.21	1.93
0.06	1.07	0.38	0.82	0.39	1.22	1.86
0.06	1.08	0.39	0.85	0.40	1.21	1.85
0.06	1.10	0.40	0.82	0.39	1.23	1.88
0.06	1.09	0.40	0.82	0.40	1.24	1.87
0.06	1.09	0.39	0.80	0.39	1.23	1.90
0.05	1.06	0.38	0.78	0.40	1.22	1.87
0.06	1.07	0.40	0.82	0.41	1.24	1.87
0.06	1.06	0.39	0.80	0.40	1.22	1.83
0.05	1.08	0.39	0.80	0.40	1.24	1.90
0.06	1.08	0.40	0.79	0.40	1.25	1.86
0.07	1.11	0.39	0.86	0.40	1.24	1.88
0.05	1.08	0.38	0.81	0.39	1.23	1.85
0.07	1.10	0.39	0.81	0.40	1.26	1.92
0.06	1.12	0.42	0.82	0.41	1.25	1.93
0.07	1.10	0.41	0.82	0.40	1.26	1.89
0.04	1.09	0.38	0.82	0.39	1.23	1.89
0.05	1.10	0.40	0.81	0.38	1.23	1.80
0.08	1.10	0.38	0.81	0.39	1.27	1.82
0.06	1.10	0.41	0.81	0.40	1.25	1.77
0.05	1.13	0.41	0.83	0.39	1.28	1.82
0.05	1.11	0.39	0.82	0.40	1.26	1.78
0.06	1.12	0.40	0.85	0.41	1.28	1.83
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.06	1.09	0.39	0.82	0.40	1.24	1.87
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.04

Table 32: The blue filtered densities of the YMCK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
1.10	0.64	0.21	1.44	0.95	0.66	1.96	0.09
1.05	0.65	0.20	1.47	0.97	0.66	1.96	0.10
1.09	0.65	0.20	1.48	0.96	0.66	1.98	0.09
1.14	0.64	0.28	1.45	0.97	0.66	1.92	0.09
1.14	0.63	0.26	1.45	0.98	0.66	1.97	0.10
1.16	0.64	0.19	1.46	0.96	0.67	1.96	0.09
1.05	0.64	0.20	1.47	0.95	0.66	1.95	0.09
1.05	0.63	0.20	1.44	0.95	0.65	1.96	0.09
1.07	0.64	0.20	1.46	0.95	0.66	1.95	0.09
1.13	0.63	0.20	1.47	0.96	0.65	1.94	0.09
1.12	0.64	0.20	1.47	0.98	0.67	1.97	0.09
1.04	0.65	0.19	1.47	0.96	0.67	1.97	0.09
1.12	0.64	0.20	1.46	0.96	0.66	1.98	0.09
1.07	0.64	0.20	1.47	0.96	0.65	1.94	0.09
1.07	0.64	0.20	1.47	0.96	0.66	1.98	0.10
1.08	0.64	0.20	1.47	0.97	0.66	1.95	0.09
1.11	0.64	0.20	1.48	0.97	0.66	1.97	0.10
1.10	0.64	0.20	1.47	0.97	0.67	1.96	0.09
1.05	0.65	0.20	1.48	0.98	0.67	1.98	0.09
1.09	0.65	0.20	1.46	0.97	0.68	1.96	0.10
1.03	0.65	0.20	1.48	0.98	0.67	2.02	0.09
1.11	0.66	0.20	1.50	0.99	0.68	2.00	0.09
1.07	0.65	0.21	1.49	0.96	0.68	1.95	0.10
1.08	0.65	0.21	1.49	0.97	0.67	2.00	0.10
1.07	0.66	0.21	1.51	0.97	0.68	1.94	0.09
1.12	0.68	0.22	1.49	0.98	0.69	1.91	0.11
1.06	0.67	0.21	1.49	0.99	0.69	1.88	0.11
1.07	0.69	0.21	1.50	0.99	0.70	1.86	0.11
1.06	0.68	0.21	1.51	1.00	0.69	1.86	0.11
1.07	0.67	0.22	1.51	1.00	0.70	1.89	0.11
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.09	0.65	0.21	1.48	0.97	0.67	1.95	0.10
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.03	0.02	0.02	0.02	0.01	0.01	0.04	0.01

Table 33: The blue filtered densities (subtracted out the paper densities) of the YMCK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
1.01	0.55	0.12	1.35	0.86	0.57	1.87
0.95	0.55	0.10	1.37	0.87	0.56	1.86
1.00	0.56	0.11	1.39	0.87	0.57	1.89
1.05	0.55	0.19	1.36	0.88	0.57	1.83
1.04	0.53	0.16	1.35	0.88	0.56	1.87
1.07	0.55	0.10	1.37	0.87	0.58	1.87
0.96	0.55	0.11	1.38	0.86	0.57	1.86
0.96	0.54	0.11	1.35	0.86	0.56	1.87
0.98	0.55	0.11	1.37	0.86	0.57	1.86
1.04	0.54	0.11	1.38	0.87	0.56	1.85
1.03	0.55	0.11	1.38	0.89	0.58	1.88
0.95	0.56	0.10	1.38	0.87	0.58	1.88
1.03	0.55	0.11	1.37	0.87	0.57	1.89
0.98	0.55	0.11	1.38	0.87	0.56	1.85
0.97	0.54	0.10	1.37	0.86	0.56	1.88
0.99	0.55	0.11	1.38	0.88	0.57	1.86
1.01	0.54	0.10	1.38	0.87	0.56	1.87
1.01	0.55	0.11	1.38	0.88	0.58	1.87
0.96	0.56	0.11	1.39	0.89	0.58	1.89
0.99	0.55	0.10	1.36	0.87	0.58	1.86
0.94	0.56	0.11	1.39	0.89	0.58	1.93
1.02	0.57	0.11	1.41	0.90	0.59	1.91
0.97	0.55	0.11	1.39	0.86	0.58	1.85
0.98	0.55	0.11	1.39	0.87	0.57	1.90
0.98	0.57	0.12	1.42	0.88	0.59	1.85
1.01	0.57	0.11	1.38	0.87	0.58	1.80
0.95	0.56	0.10	1.38	0.88	0.58	1.77
0.96	0.58	0.10	1.39	0.88	0.59	1.75
0.95	0.57	0.10	1.40	0.89	0.58	1.75
0.96	0.56	0.11	1.40	0.89	0.59	1.78
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.99	0.55	0.11	1.38	0.87	0.57	1.85
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.03	0.01	0.02	0.02	0.01	0.01	0.04

Table34: The visual filtered densities of the YMCK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.33	0.83	0.37	0.95	0.65	0.97	1.98	0.09
0.31	0.84	0.38	0.93	0.64	0.98	1.99	0.09
0.30	0.82	0.39	0.95	0.64	0.97	1.99	0.09
0.31	0.81	0.37	0.91	0.64	0.96	1.95	0.08
0.31	0.82	0.36	0.92	0.63	0.97	1.92	0.09
0.32	0.81	0.37	0.95	0.63	0.96	1.98	0.08
0.34	0.82	0.36	0.91	0.64	0.95	1.95	0.09
0.31	0.81	0.36	0.92	0.63	0.97	2.01	0.09
0.32	0.82	0.36	0.92	0.63	0.95	1.93	0.09
0.31	0.83	0.37	0.93	0.64	0.95	1.89	0.09
0.31	0.82	0.36	0.92	0.64	0.97	1.96	0.09
0.30	0.82	0.36	0.91	0.64	0.96	1.92	0.09
0.32	0.81	0.37	0.92	0.63	0.96	1.99	0.09
0.35	0.82	0.38	0.92	0.64	0.96	1.94	0.08
0.31	0.82	0.36	0.92	0.64	0.98	1.96	0.09
0.31	0.81	0.36	0.91	0.66	0.95	1.94	0.10
0.30	0.84	0.37	0.93	0.64	0.97	1.97	0.09
0.31	0.84	0.38	0.93	0.64	0.98	1.94	0.10
0.29	0.83	0.37	0.93	0.64	0.96	1.95	0.09
0.30	0.83	0.38	0.91	0.64	0.97	1.92	0.08
0.32	0.83	0.37	0.93	0.65	0.97	1.95	0.09
0.33	0.85	0.37	0.93	0.65	0.98	1.95	0.09
0.31	0.82	0.38	0.92	0.63	0.97	1.98	0.09
0.31	0.83	0.38	0.93	0.64	0.98	1.98	0.09
0.32	0.85	0.38	0.94	0.65	0.98	1.93	0.09
0.32	0.84	0.39	0.91	0.65	1.00	1.85	0.11
0.33	0.85	0.38	0.92	0.65	0.98	1.90	0.10
0.33	0.86	0.38	0.93	0.67	1.00	1.92	0.09
0.31	0.85	0.38	0.94	0.65	0.99	1.87	0.11
0.32	0.85	0.40	0.95	0.67	0.99	1.90	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.32	0.83	0.37	0.93	0.64	0.97	1.94	0.09
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.04	0.01

Table 35: The visual filtered densities (subtracted out the paper densities) of

the YMCK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.24	0.74	0.28	0.86	0.56	0.88	1.89
0.22	0.75	0.29	0.84	0.55	0.89	1.90
0.21	0.73	0.30	0.86	0.55	0.88	1.90
0.23	0.73	0.29	0.83	0.56	0.88	1.87
0.22	0.73	0.27	0.83	0.54	0.88	1.83
0.24	0.73	0.29	0.87	0.55	0.88	1.90
0.25	0.73	0.27	0.82	0.55	0.86	1.86
0.22	0.72	0.27	0.83	0.54	0.88	1.92
0.23	0.73	0.27	0.83	0.54	0.86	1.84
0.22	0.74	0.28	0.84	0.55	0.86	1.80
0.22	0.73	0.27	0.83	0.55	0.88	1.87
0.21	0.73	0.27	0.82	0.55	0.87	1.83
0.23	0.72	0.28	0.83	0.54	0.87	1.90
0.27	0.74	0.30	0.84	0.56	0.88	1.86
0.22	0.73	0.27	0.83	0.55	0.89	1.87
0.21	0.71	0.26	0.81	0.56	0.85	1.84
0.21	0.75	0.28	0.84	0.55	0.88	1.88
0.21	0.74	0.28	0.83	0.54	0.88	1.84
0.20	0.74	0.28	0.84	0.55	0.87	1.86
0.22	0.75	0.30	0.83	0.56	0.89	1.84
0.23	0.74	0.28	0.84	0.56	0.88	1.86
0.24	0.76	0.28	0.84	0.56	0.89	1.86
0.22	0.73	0.29	0.83	0.54	0.88	1.89
0.22	0.74	0.29	0.84	0.55	0.89	1.89
0.23	0.76	0.29	0.85	0.56	0.89	1.84
0.21	0.73	0.28	0.80	0.54	0.89	1.74
0.23	0.75	0.28	0.82	0.55	0.88	1.80
0.24	0.77	0.29	0.84	0.58	0.91	1.83
0.20	0.74	0.27	0.83	0.54	0.88	1.76
0.22	0.75	0.30	0.85	0.57	0.89	1.80
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.22	0.74	0.28	0.83	0.55	0.88	1.85
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.04

Table 36: The red filtered densities of the YCMK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.13	0.24	1.37	0.23	1.13	1.28	1.78	0.13
0.15	0.26	1.41	0.23	1.16	1.27	1.74	0.11
0.14	0.24	1.38	0.24	1.16	1.31	1.82	0.11
0.16	0.25	1.35	0.24	1.15	1.29	1.79	0.11
0.16	0.23	1.34	0.24	1.15	1.28	1.74	0.11
0.14	0.24	1.39	0.23	1.14	1.29	1.77	0.13
0.16	0.23	1.37	0.23	1.18	1.27	1.77	0.12
0.16	0.23	1.35	0.23	1.15	1.30	1.80	0.12
0.15	0.24	1.34	0.23	1.14	1.29	1.85	0.11
0.17	0.25	1.34	0.22	1.13	1.27	1.83	0.10
0.12	0.22	1.35	0.22	1.15	1.26	1.84	0.11
0.13	0.25	1.33	0.23	1.10	1.28	1.89	0.10
0.14	0.23	1.36	0.22	1.12	1.29	1.85	0.11
0.14	0.23	1.39	0.22	1.13	1.28	1.87	0.11
0.14	0.23	1.37	0.25	1.17	1.28	1.87	0.10
0.14	0.22	1.38	0.23	1.11	1.26	1.90	0.11
0.15	0.23	1.36	0.22	1.11	1.27	1.90	0.11
0.13	0.23	1.34	0.23	1.14	1.27	1.89	0.12
0.14	0.23	1.37	0.23	1.15	1.28	1.89	0.11
0.14	0.24	1.36	0.23	1.15	1.30	1.89	0.11
0.15	0.24	1.37	0.24	1.16	1.29	1.85	0.11
0.14	0.23	1.36	0.24	1.14	1.29	1.81	0.12
0.15	0.26	1.36	0.25	1.15	1.30	1.81	0.12
0.16	0.23	1.35	0.24	1.14	1.28	1.89	0.12
0.15	0.23	1.36	0.23	1.12	1.28	1.89	0.11
0.15	0.25	1.34	0.24	1.11	1.27	1.85	0.11
0.15	0.24	1.38	0.23	1.14	1.27	1.87	0.11
0.14	0.23	1.35	0.23	1.17	1.27	1.84	0.11
0.15	0.24	1.34	0.23	1.14	1.28	1.85	0.11
0.18	0.25	1.34	0.23	1.13	1.31	1.85	0.12
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.15	0.24	1.36	0.23	1.14	1.28	1.84	0.11
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.02	0.01	0.05	0.01

Table 37: The red filtered densities (subtracted out the paper densities) of the YCMK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.00	0.11	1.24	0.10	1.00	1.15	1.65
0.04	0.15	1.30	0.12	1.05	1.16	1.63
0.03	0.13	1.27	0.13	1.05	1.20	1.71
0.05	0.14	1.24	0.13	1.04	1.18	1.68
0.05	0.12	1.23	0.13	1.04	1.17	1.63
0.01	0.11	1.26	0.10	1.01	1.16	1.64
0.04	0.11	1.25	0.11	1.06	1.15	1.65
0.04	0.11	1.23	0.11	1.03	1.18	1.68
0.04	0.13	1.23	0.12	1.03	1.18	1.74
0.07	0.15	1.24	0.12	1.03	1.17	1.73
0.01	0.11	1.24	0.11	1.04	1.15	1.73
0.03	0.15	1.23	0.13	1.00	1.18	1.79
0.03	0.12	1.25	0.11	1.01	1.18	1.74
0.03	0.12	1.28	0.11	1.02	1.17	1.76
0.04	0.13	1.27	0.15	1.07	1.18	1.77
0.03	0.11	1.27	0.12	1.00	1.15	1.79
0.04	0.12	1.25	0.11	1.00	1.16	1.79
0.01	0.11	1.22	0.11	1.02	1.15	1.77
0.03	0.12	1.26	0.12	1.04	1.17	1.78
0.03	0.13	1.25	0.12	1.04	1.19	1.78
0.04	0.13	1.26	0.13	1.05	1.18	1.74
0.02	0.11	1.24	0.12	1.02	1.17	1.69
0.03	0.14	1.24	0.13	1.03	1.18	1.69
0.04	0.11	1.23	0.12	1.02	1.16	1.77
0.04	0.12	1.25	0.12	1.01	1.17	1.78
0.04	0.14	1.23	0.13	1.00	1.16	1.74
0.04	0.13	1.27	0.12	1.03	1.16	1.76
0.03	0.12	1.24	0.12	1.06	1.16	1.73
0.04	0.13	1.23	0.12	1.03	1.17	1.74
0.06	0.13	1.22	0.11	1.01	1.19	1.73
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.03	0.12	1.25	0.12	1.03	1.17	1.73
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.02	0.01	0.05

Table 38: The green filtered densities of the YCMK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.16	1.23	0.51	1.03	0.48	1.29	1.79	0.12
0.17	1.25	0.52	1.05	0.49	1.29	1.75	0.11
0.16	1.24	0.51	1.07	0.49	1.30	1.83	0.11
0.16	1.26	0.51	1.06	0.49	1.30	1.80	0.11
0.15	1.26	0.49	1.09	0.49	1.31	1.75	0.11
0.16	1.23	0.51	1.03	0.49	1.28	1.78	0.12
0.17	1.24	0.51	1.04	0.49	1.28	1.78	0.11
0.17	1.23	0.50	1.05	0.50	1.32	1.81	0.12
0.16	1.25	0.50	1.04	0.49	1.30	1.85	0.15
0.19	1.25	0.50	1.05	0.48	1.29	1.86	0.09
0.14	1.23	0.49	1.05	0.48	1.28	1.87	0.10
0.15	1.22	0.49	1.03	0.47	1.27	1.90	0.10
0.15	1.22	0.49	1.04	0.47	1.26	1.86	0.10
0.16	1.22	0.50	1.04	0.47	1.28	1.89	0.10
0.15	1.23	0.49	1.05	0.48	1.27	1.88	0.10
0.16	1.18	0.51	1.00	0.48	1.27	1.90	0.10
0.16	1.21	0.49	1.05	0.47	1.26	1.91	0.10
0.15	1.21	0.48	1.03	0.48	1.29	1.89	0.11
0.15	1.22	0.49	1.03	0.48	1.27	1.90	0.10
0.15	1.22	0.49	1.03	0.48	1.29	1.90	0.11
0.16	1.22	0.49	1.02	0.48	1.25	1.85	0.10
0.16	1.21	0.49	1.03	0.48	1.26	1.82	0.10
0.17	1.24	0.49	1.04	0.48	1.29	1.80	0.10
0.16	1.22	0.49	1.05	0.48	1.28	1.90	0.11
0.16	1.22	0.49	1.01	0.47	1.27	1.89	0.10
0.16	1.23	0.49	1.04	0.47	1.31	1.85	0.10
0.16	1.24	0.50	1.00	0.48	1.28	1.86	0.10
0.17	1.21	0.49	1.01	0.48	1.28	1.84	0.10
0.16	1.23	0.48	1.00	0.47	1.28	1.85	0.10
0.17	1.24	0.49	1.02	0.49	1.25	1.86	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.16	1.23	0.50	1.04	0.48	1.28	1.85	0.11
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.05	0.01

Table 39: The green filtered densities (subtracted out the paper densities) of the YCMK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.04	1.11	0.39	0.91	0.36	1.17	1.67
0.06	1.14	0.41	0.94	0.38	1.18	1.64
0.05	1.13	0.40	0.96	0.38	1.19	1.72
0.05	1.15	0.40	0.95	0.38	1.19	1.69
0.04	1.15	0.38	0.98	0.38	1.20	1.64
0.04	1.11	0.39	0.91	0.37	1.16	1.66
0.06	1.13	0.40	0.93	0.38	1.17	1.67
0.05	1.11	0.38	0.93	0.38	1.20	1.69
0.01	1.10	0.35	0.89	0.34	1.15	1.70
0.10	1.16	0.41	0.96	0.39	1.20	1.77
0.04	1.13	0.39	0.95	0.38	1.18	1.77
0.05	1.12	0.39	0.93	0.37	1.17	1.80
0.05	1.12	0.39	0.94	0.37	1.16	1.76
0.06	1.12	0.40	0.94	0.37	1.18	1.79
0.05	1.13	0.39	0.95	0.38	1.17	1.78
0.06	1.08	0.41	0.90	0.38	1.17	1.80
0.06	1.11	0.39	0.95	0.37	1.16	1.81
0.04	1.10	0.37	0.92	0.37	1.18	1.78
0.05	1.12	0.39	0.93	0.38	1.17	1.80
0.04	1.11	0.38	0.92	0.37	1.18	1.79
0.06	1.12	0.39	0.92	0.38	1.15	1.75
0.06	1.11	0.39	0.93	0.38	1.16	1.72
0.07	1.14	0.39	0.94	0.38	1.19	1.70
0.05	1.11	0.38	0.94	0.37	1.17	1.79
0.06	1.12	0.39	0.91	0.37	1.17	1.79
0.06	1.13	0.39	0.94	0.37	1.21	1.75
0.06	1.14	0.40	0.90	0.38	1.18	1.76
0.07	1.11	0.39	0.91	0.38	1.18	1.74
0.06	1.13	0.38	0.90	0.37	1.18	1.75
0.07	1.14	0.39	0.92	0.39	1.15	1.76
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.05	1.12	0.39	0.93	0.37	1.18	1.74
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.05

Table 40: The blue filtered densities of the YCMK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
1.15	0.68	0.22	1.54	0.98	0.65	1.77	0.11
1.16	0.70	0.21	1.54	0.99	0.65	1.83	0.11
1.14	0.68	0.21	1.56	0.99	0.65	1.82	0.11
1.18	0.69	0.21	1.58	0.97	0.67	1.79	0.11
1.02	0.69	0.22	1.59	0.99	0.66	1.75	0.12
1.13	0.67	0.23	1.55	0.97	0.66	1.78	0.11
1.14	0.68	0.21	1.56	0.97	0.65	1.78	0.11
1.16	0.67	0.21	1.55	0.99	0.66	1.79	0.11
1.16	0.68	0.20	1.56	0.99	0.66	1.84	0.11
1.18	0.68	0.20	1.56	1.00	0.66	1.86	0.10
1.16	0.67	0.22	1.55	0.97	0.65	1.85	0.11
1.16	0.67	0.21	1.55	0.99	0.64	1.89	0.10
1.16	0.68	0.21	1.56	0.99	0.65	1.84	0.12
1.17	0.67	0.21	1.55	0.98	0.66	1.88	0.11
1.17	0.68	0.21	1.54	0.97	0.66	1.86	0.12
1.15	0.66	0.21	1.55	0.99	0.65	1.90	0.11
1.16	0.68	0.22	1.55	0.99	0.64	1.91	0.11
1.16	0.67	0.21	1.55	0.99	0.66	1.88	0.12
1.17	0.68	0.22	1.56	0.98	0.65	1.89	0.11
1.17	0.68	0.21	1.54	0.99	0.66	1.89	0.12
1.17	0.67	0.21	1.55	0.99	0.65	1.84	0.13
1.16	0.68	0.21	1.54	0.99	0.65	1.81	0.11
1.16	0.69	0.22	1.55	0.99	0.68	1.80	0.12
1.18	0.68	0.21	1.56	1.00	0.66	1.89	0.11
1.16	0.68	0.21	1.55	1.00	0.65	1.88	0.11
1.16	0.68	0.22	1.55	0.97	0.67	1.85	0.11
1.17	0.70	0.21	1.55	0.96	0.66	1.87	0.11
1.18	0.67	0.21	1.55	0.98	0.65	1.85	0.11
1.15	0.68	0.21	1.53	0.98	0.67	1.86	0.11
1.17	0.68	0.22	1.55	0.99	0.65	1.85	0.12
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.16	0.68	0.21	1.55	0.98	0.66	1.84	0.11
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.03	0.01	0.01	0.01	0.01	0.01	0.04	0.01

Table 41: The blue filtered densities (subtracted out the paper densities) of the YCMK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
1.04	0.57	0.11	1.43	0.87	0.54	1.66
1.05	0.59	0.10	1.43	0.88	0.54	1.72
1.03	0.57	0.10	1.45	0.88	0.54	1.71
1.07	0.58	0.10	1.47	0.86	0.56	1.68
0.90	0.57	0.10	1.47	0.87	0.54	1.63
1.02	0.56	0.12	1.44	0.86	0.55	1.67
1.03	0.57	0.10	1.45	0.86	0.54	1.67
1.05	0.56	0.10	1.44	0.88	0.55	1.68
1.05	0.57	0.09	1.45	0.88	0.55	1.73
1.08	0.58	0.10	1.46	0.90	0.56	1.76
1.05	0.56	0.11	1.44	0.86	0.54	1.74
1.06	0.57	0.11	1.45	0.89	0.54	1.79
1.04	0.56	0.09	1.44	0.87	0.53	1.72
1.06	0.56	0.10	1.44	0.87	0.55	1.77
1.05	0.56	0.09	1.42	0.85	0.54	1.74
1.04	0.55	0.10	1.44	0.88	0.54	1.79
1.05	0.57	0.11	1.44	0.88	0.53	1.80
1.04	0.55	0.09	1.43	0.87	0.54	1.76
1.06	0.57	0.11	1.45	0.87	0.54	1.78
1.05	0.56	0.09	1.42	0.87	0.54	1.77
1.04	0.54	0.08	1.42	0.86	0.52	1.71
1.05	0.57	0.10	1.43	0.88	0.54	1.70
1.04	0.57	0.10	1.43	0.87	0.56	1.68
1.07	0.57	0.10	1.45	0.89	0.55	1.78
1.05	0.57	0.10	1.44	0.89	0.54	1.77
1.05	0.57	0.11	1.44	0.86	0.56	1.74
1.06	0.59	0.10	1.44	0.85	0.55	1.76
1.07	0.56	0.10	1.44	0.87	0.54	1.74
1.04	0.57	0.10	1.42	0.87	0.56	1.75
1.05	0.56	0.10	1.43	0.87	0.53	1.73
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.04	0.57	0.10	1.44	0.87	0.54	1.73
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.03	0.01	0.01	0.01	0.01	0.01	0.04

Table 42: The visual filtered densities of the YCMK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.33	0.87	0.40	1.02	0.66	0.96	1.78	0.10
0.34	0.90	0.40	1.03	0.65	0.95	1.75	0.10
0.34	0.88	0.39	1.04	0.64	0.97	1.83	0.11
0.34	0.88	0.39	1.04	0.65	0.96	1.79	0.12
0.32	0.87	0.39	1.06	0.65	0.97	1.74	0.11
0.34	0.88	0.40	1.02	0.64	0.95	1.77	0.11
0.33	0.87	0.40	1.04	0.65	0.95	1.77	0.12
0.34	0.86	0.39	1.04	0.65	0.97	1.80	0.11
0.34	0.88	0.39	1.02	0.65	0.96	1.84	0.13
0.34	0.88	0.39	1.03	0.63	0.96	1.83	0.09
0.32	0.85	0.39	1.02	0.63	0.94	1.84	0.09
0.32	0.86	0.37	1.01	0.62	0.94	1.88	0.09
0.32	0.87	0.37	1.02	0.62	0.94	1.84	0.09
0.32	0.84	0.37	1.02	0.63	0.94	1.87	0.09
0.32	0.87	0.37	1.02	0.63	0.93	1.86	0.09
0.32	0.83	0.37	1.01	0.63	0.93	1.91	0.10
0.32	0.84	0.37	1.02	0.62	0.92	1.90	0.09
0.32	0.84	0.37	1.01	0.63	0.94	1.86	0.10
0.33	0.85	0.38	1.01	0.63	0.94	1.88	0.09
0.32	0.84	0.38	1.01	0.63	0.96	1.88	0.09
0.32	0.86	0.37	1.01	0.64	0.92	1.83	0.10
0.33	0.87	0.37	1.01	0.63	0.94	1.79	0.11
0.32	0.86	0.39	1.02	0.63	0.94	1.78	0.09
0.33	0.85	0.37	1.02	0.63	0.94	1.88	0.10
0.34	0.85	0.37	1.00	0.62	0.94	1.87	0.09
0.34	0.87	0.38	1.02	0.62	0.96	1.84	0.09
0.34	0.88	0.38	1.00	0.62	0.94	1.85	0.09
0.33	0.83	0.37	1.00	0.63	0.94	1.83	0.09
0.32	0.85	0.37	0.99	0.63	0.94	1.84	0.09
0.35	0.86	0.39	1.00	0.63	0.93	1.84	0.09
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.33	0.86	0.38	1.02	0.63	0.95	1.83	0.10
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.10	0.13	0.11	0.12	0.10	0.12	0.21	0.11

Table 43: The visual filtered densities (subtracted out the paper densities) of the YCMK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.23	0.77	0.30	0.92	0.56	0.86	1.68
0.24	0.80	0.30	0.93	0.55	0.85	1.65
0.23	0.77	0.28	0.93	0.53	0.86	1.72
0.22	0.76	0.27	0.92	0.53	0.84	1.67
0.21	0.76	0.28	0.95	0.54	0.86	1.63
0.23	0.77	0.29	0.91	0.53	0.84	1.66
0.21	0.75	0.28	0.92	0.53	0.83	1.65
0.23	0.75	0.28	0.93	0.54	0.86	1.69
0.21	0.75	0.26	0.89	0.52	0.83	1.71
0.25	0.79	0.30	0.94	0.54	0.87	1.74
0.23	0.76	0.30	0.93	0.54	0.85	1.75
0.23	0.77	0.28	0.92	0.53	0.85	1.79
0.23	0.78	0.28	0.93	0.53	0.85	1.75
0.23	0.75	0.28	0.93	0.54	0.85	1.78
0.23	0.78	0.28	0.93	0.54	0.84	1.77
0.22	0.73	0.27	0.91	0.53	0.83	1.81
0.23	0.75	0.28	0.93	0.53	0.83	1.81
0.22	0.74	0.27	0.91	0.53	0.84	1.76
0.24	0.76	0.29	0.92	0.54	0.85	1.79
0.23	0.75	0.29	0.92	0.54	0.87	1.79
0.22	0.76	0.27	0.91	0.54	0.82	1.73
0.22	0.76	0.26	0.90	0.52	0.83	1.68
0.23	0.77	0.30	0.93	0.54	0.85	1.69
0.23	0.75	0.27	0.92	0.53	0.84	1.78
0.25	0.76	0.28	0.91	0.53	0.85	1.78
0.25	0.78	0.29	0.93	0.53	0.87	1.75
0.25	0.79	0.29	0.91	0.53	0.85	1.76
0.24	0.74	0.28	0.91	0.54	0.85	1.74
0.23	0.76	0.28	0.90	0.54	0.85	1.75
0.26	0.77	0.30	0.91	0.54	0.84	1.75
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.23	0.76	0.28	0.92	0.53	0.85	1.74
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.11	0.13	0.11	0.12	0.08	0.11	0.23

Table 44: The red filtered densities of the CMYK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.09	0.21	1.34	0.20	1.24	1.18	1.93	0.08
0.09	0.20	1.35	0.20	1.26	1.21	1.94	0.07
0.10	0.20	1.36	0.20	1.24	1.21	1.93	0.08
0.10	0.21	1.36	0.20	1.25	1.17	1.93	0.10
0.11	0.22	1.34	0.21	1.26	1.17	1.93	0.10
0.12	0.21	1.36	0.21	1.28	1.22	1.92	0.08
0.11	0.23	1.35	0.24	1.26	1.25	1.95	0.11
0.11	0.21	1.37	0.21	1.26	1.19	1.95	0.09
0.12	0.22	1.31	0.21	1.25	1.26	1.97	0.09
0.11	0.21	1.33	0.21	1.26	1.22	1.92	0.09
0.12	0.21	1.37	0.22	1.27	1.24	1.95	0.11
0.11	0.23	1.37	0.21	1.26	1.19	1.94	0.11
0.12	0.23	1.39	0.21	1.25	1.19	1.93	0.09
0.11	0.22	1.36	0.21	1.27	1.22	1.98	0.09
0.11	0.21	1.36	0.21	1.26	1.21	1.96	0.09
0.12	0.22	1.35	0.22	1.27	1.23	1.90	0.09
0.11	0.21	1.35	0.21	1.25	1.20	1.93	0.09
0.13	0.22	1.38	0.21	1.26	1.22	1.95	0.09
0.11	0.23	1.38	0.22	1.26	1.21	1.91	0.09
0.12	0.23	1.36	0.21	1.28	1.22	1.91	0.10
0.11	0.22	1.38	0.21	1.28	1.22	1.93	0.10
0.11	0.22	1.32	0.21	1.27	1.25	1.90	0.09
0.11	0.22	1.35	0.21	1.27	1.22	1.94	0.09
0.11	0.21	1.34	0.21	1.28	1.21	1.86	0.09
0.12	0.22	1.34	0.22	1.27	1.24	1.94	0.11
0.11	0.21	1.39	0.21	1.27	1.23	1.87	0.09
0.12	0.22	1.33	0.21	1.29	1.19	1.91	0.10
0.11	0.22	1.36	0.22	1.26	1.24	1.94	0.10
0.12	0.21	1.35	0.23	1.28	1.23	1.86	0.10
0.12	0.23	1.34	0.22	1.26	1.22	1.91	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.11	0.22	1.35	0.21	1.26	1.22	1.93	0.09
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.01	0.02	0.03	0.01

Table 45: The red filtered densities (subtracted out the paper densities) of the CMYK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.01	0.13	1.26	0.12	1.16	1.10	1.85
0.02	0.13	1.28	0.13	1.19	1.14	1.87
0.02	0.12	1.28	0.12	1.16	1.13	1.85
0.00	0.11	1.26	0.10	1.15	1.07	1.83
0.01	0.12	1.24	0.11	1.16	1.07	1.83
0.04	0.13	1.28	0.13	1.20	1.14	1.84
0.00	0.12	1.24	0.13	1.15	1.14	1.84
0.02	0.12	1.28	0.12	1.17	1.10	1.86
0.03	0.13	1.22	0.12	1.16	1.17	1.88
0.02	0.12	1.24	0.12	1.17	1.13	1.83
0.01	0.10	1.26	0.11	1.16	1.13	1.84
0.00	0.12	1.26	0.10	1.15	1.08	1.83
0.03	0.14	1.30	0.12	1.16	1.10	1.84
0.02	0.13	1.27	0.12	1.18	1.13	1.89
0.02	0.12	1.27	0.12	1.17	1.12	1.87
0.03	0.13	1.26	0.13	1.18	1.14	1.81
0.02	0.12	1.26	0.12	1.16	1.11	1.84
0.04	0.13	1.29	0.12	1.17	1.13	1.86
0.02	0.14	1.29	0.13	1.17	1.12	1.82
0.02	0.13	1.26	0.11	1.18	1.12	1.81
0.01	0.12	1.28	0.11	1.18	1.12	1.83
0.02	0.13	1.23	0.12	1.18	1.16	1.81
0.02	0.13	1.26	0.12	1.18	1.13	1.85
0.02	0.12	1.25	0.12	1.19	1.12	1.77
0.01	0.11	1.23	0.11	1.16	1.13	1.83
0.02	0.12	1.30	0.12	1.18	1.14	1.78
0.02	0.12	1.23	0.11	1.19	1.09	1.81
0.01	0.12	1.26	0.12	1.16	1.14	1.84
0.02	0.11	1.25	0.13	1.18	1.13	1.76
0.02	0.13	1.24	0.12	1.16	1.12	1.81
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.02	0.12	1.26	0.12	1.17	1.12	1.83
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.01	0.02	0.03

Table 46: The green filtered densities of the CMYK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.14	1.21	0.48	1.16	0.50	1.24	1.93	0.10
0.15	1.18	0.49	1.14	0.52	1.23	1.97	0.09
0.15	1.20	0.50	1.13	0.51	1.23	1.95	0.10
0.15	1.19	0.50	1.12	0.51	1.23	1.96	0.09
0.15	1.19	0.49	1.12	0.52	1.23	1.95	0.12
0.17	1.21	0.50	1.15	0.52	1.21	1.93	0.09
0.15	1.20	0.49	1.15	0.52	1.24	1.97	0.11
0.16	1.21	0.50	1.13	0.52	1.25	1.97	0.10
0.17	1.23	0.49	1.15	0.52	1.26	1.99	0.11
0.15	1.20	0.49	1.15	0.52	1.24	1.96	0.10
0.15	1.20	0.50	1.13	0.52	1.22	1.97	0.10
0.16	1.19	0.50	1.13	0.52	1.21	1.96	0.10
0.14	1.19	0.51	1.14	0.52	1.21	1.93	0.11
0.15	1.18	0.50	1.15	0.52	1.23	1.99	0.10
0.15	1.20	0.50	1.15	0.52	1.20	1.97	0.10
0.15	1.19	0.50	1.15	0.52	1.22	1.92	0.09
0.15	1.18	0.50	1.16	0.52	1.21	1.95	0.09
0.15	1.21	0.51	1.14	0.53	1.23	1.97	0.10
0.16	1.22	0.51	1.13	0.52	1.21	1.94	0.10
0.17	1.18	0.51	1.13	0.52	1.24	1.94	0.10
0.15	1.20	0.50	1.14	0.52	1.21	1.95	0.10
0.15	1.19	0.49	1.14	0.52	1.23	1.95	0.11
0.15	1.18	0.50	1.16	0.52	1.24	1.96	0.10
0.16	1.19	0.49	1.15	0.53	1.24	1.88	0.10
0.15	1.18	0.49	1.15	0.52	1.21	1.96	0.10
0.15	1.19	0.51	1.14	0.52	1.23	1.90	0.10
0.15	1.18	0.49	1.14	0.54	1.23	1.93	0.10
0.15	1.19	0.50	1.15	0.54	1.25	1.96	0.10
0.16	1.18	0.50	1.16	0.52	1.22	1.88	0.10
0.16	1.21	0.49	1.14	0.53	1.23	1.94	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.15	1.19	0.50	1.14	0.52	1.23	1.95	0.10
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01

Table 47: The green filtered densities (subtracted out the paper densities) of the CMYK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.04	1.11	0.38	1.06	0.40	1.14	1.83
0.06	1.09	0.40	1.05	0.43	1.14	1.88
0.05	1.10	0.40	1.03	0.41	1.13	1.85
0.06	1.10	0.41	1.03	0.42	1.14	1.87
0.03	1.07	0.37	1.00	0.40	1.11	1.83
0.08	1.12	0.41	1.06	0.43	1.12	1.84
0.04	1.09	0.38	1.04	0.41	1.13	1.86
0.06	1.11	0.40	1.03	0.42	1.15	1.87
0.06	1.12	0.38	1.04	0.41	1.15	1.88
0.05	1.10	0.39	1.05	0.42	1.14	1.86
0.05	1.10	0.40	1.03	0.42	1.12	1.87
0.06	1.09	0.40	1.03	0.42	1.11	1.86
0.03	1.08	0.40	1.03	0.41	1.10	1.82
0.05	1.08	0.40	1.05	0.42	1.13	1.89
0.05	1.10	0.40	1.05	0.42	1.10	1.87
0.06	1.10	0.41	1.06	0.43	1.13	1.83
0.06	1.09	0.41	1.07	0.43	1.12	1.86
0.05	1.11	0.41	1.04	0.43	1.13	1.87
0.06	1.12	0.41	1.03	0.42	1.11	1.84
0.07	1.08	0.41	1.03	0.42	1.14	1.84
0.05	1.10	0.40	1.04	0.42	1.11	1.85
0.04	1.08	0.38	1.03	0.41	1.12	1.84
0.05	1.08	0.40	1.06	0.42	1.14	1.86
0.06	1.09	0.39	1.05	0.43	1.14	1.78
0.05	1.08	0.39	1.05	0.42	1.11	1.86
0.05	1.09	0.41	1.04	0.42	1.13	1.80
0.05	1.08	0.39	1.04	0.44	1.13	1.83
0.05	1.09	0.40	1.05	0.44	1.15	1.86
0.06	1.08	0.40	1.06	0.42	1.12	1.78
0.06	1.11	0.39	1.04	0.43	1.13	1.84
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.05	1.09	0.40	1.04	0.42	1.13	1.85
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.03

Table 48: The blue filtered densities of the CMYK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
1.08	0.65	0.19	1.43	0.86	0.62	1.93	0.09
1.09	0.63	0.20	1.41	0.89	0.61	1.96	0.08
1.05	0.65	0.20	1.41	0.89	0.61	1.95	0.09
1.09	0.64	0.20	1.40	0.87	0.63	1.95	0.09
1.06	0.64	0.20	1.42	0.88	0.61	1.94	0.09
1.10	0.67	0.21	1.43	0.87	0.60	1.92	0.10
1.10	0.64	0.21	1.43	0.89	0.62	1.96	0.10
1.11	0.66	0.20	1.45	0.89	0.62	1.98	0.10
1.08	0.64	0.20	1.41	0.87	0.61	1.94	0.10
1.09	0.65	0.20	1.40	0.87	0.60	1.95	0.09
1.10	0.65	0.20	1.43	0.90	0.61	1.95	0.10
1.07	0.65	0.20	1.43	0.91	0.61	1.93	0.10
1.09	0.64	0.20	1.45	0.86	0.61	1.98	0.10
1.09	0.65	0.20	1.42	0.88	0.60	1.96	0.09
1.09	0.64	0.21	1.44	0.87	0.60	1.92	0.09
1.06	0.63	0.20	1.45	0.89	0.60	1.94	0.09
1.09	0.67	0.20	1.44	0.87	0.61	1.96	0.10
1.11	0.65	0.21	1.41	0.88	0.60	1.93	0.10
1.10	0.63	0.21	1.43	0.89	0.61	1.93	0.09
1.06	0.65	0.20	1.43	0.88	0.60	1.93	0.10
1.09	0.65	0.20	1.42	0.87	0.61	1.94	0.09
1.06	0.64	0.20	1.45	0.89	0.61	1.96	0.09
1.08	0.64	0.22	1.45	0.87	0.62	1.87	0.09
1.06	0.65	0.20	1.43	0.88	0.60	1.96	0.09
1.05	0.64	0.21	1.42	0.87	0.61	1.90	0.09
1.03	0.64	0.20	1.39	0.90	0.61	1.93	0.09
1.07	0.65	0.21	1.42	0.89	0.62	1.95	0.10
1.10	0.64	0.20	1.46	0.88	0.61	1.88	0.09
1.09	0.65	0.21	1.41	0.89	0.62	1.93	0.10
1.05	0.65	0.20	1.40	0.88	0.61	1.87	0.09
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.08	0.65	0.20	1.43	0.88	0.61	1.94	0.09
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.02	0.01	0.01	0.02	0.01	0.01	0.03	0.01

Table 49: The blue filtered densities (subtracted out the paper densities) of the CMYK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.99	0.56	0.10	1.34	0.77	0.53	1.84
1.01	0.55	0.12	1.33	0.81	0.53	1.88
0.96	0.56	0.11	1.32	0.80	0.52	1.86
1.00	0.55	0.11	1.31	0.78	0.54	1.86
0.97	0.55	0.11	1.33	0.79	0.52	1.85
1.00	0.57	0.11	1.33	0.77	0.50	1.82
1.00	0.54	0.11	1.33	0.79	0.52	1.86
1.01	0.56	0.10	1.35	0.79	0.52	1.88
0.98	0.54	0.10	1.31	0.77	0.51	1.84
1.00	0.56	0.11	1.31	0.78	0.51	1.86
1.00	0.55	0.10	1.33	0.80	0.51	1.85
0.97	0.55	0.10	1.33	0.81	0.51	1.83
0.99	0.54	0.10	1.35	0.76	0.51	1.88
1.00	0.56	0.11	1.33	0.79	0.51	1.87
1.00	0.55	0.12	1.35	0.78	0.51	1.83
0.97	0.54	0.11	1.36	0.80	0.51	1.85
0.99	0.57	0.10	1.34	0.77	0.51	1.86
1.01	0.55	0.11	1.31	0.78	0.50	1.83
1.01	0.54	0.12	1.34	0.80	0.52	1.84
0.96	0.55	0.10	1.33	0.78	0.50	1.83
1.00	0.56	0.11	1.33	0.78	0.52	1.85
0.97	0.55	0.11	1.36	0.80	0.52	1.87
0.99	0.55	0.13	1.36	0.78	0.53	1.78
0.97	0.56	0.11	1.34	0.79	0.51	1.87
0.96	0.55	0.12	1.33	0.78	0.52	1.81
0.94	0.55	0.11	1.30	0.81	0.52	1.84
0.97	0.55	0.11	1.32	0.79	0.52	1.85
1.01	0.55	0.11	1.37	0.79	0.52	1.79
0.99	0.55	0.11	1.31	0.79	0.52	1.83
0.96	0.56	0.11	1.31	0.79	0.52	1.78
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.99	0.55	0.11	1.33	0.79	0.52	1.84
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.02	0.01	0.01	0.02	0.01	0.01	0.03

Table 50: The visual filtered densities of the CMYK sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.31	0.84	0.38	1.07	0.64	0.92	1.94	0.09
0.32	0.83	0.38	1.05	0.64	0.91	1.97	0.09
0.37	0.83	0.38	1.05	0.64	0.92	1.95	0.09
0.32	0.83	0.39	1.04	0.65	0.90	1.96	0.09
0.32	0.85	0.38	1.04	0.65	0.91	1.95	0.12
0.32	0.85	0.39	1.06	0.65	0.90	1.93	0.10
0.32	0.84	0.40	1.06	0.65	0.92	1.96	0.11
0.33	0.85	0.39	1.05	0.65	0.92	1.96	0.10
0.34	0.85	0.38	1.07	0.65	0.93	1.99	0.09
0.31	0.84	0.39	1.06	0.65	0.92	1.94	0.09
0.32	0.84	0.38	1.05	0.65	0.91	1.96	0.09
0.33	0.82	0.38	1.05	0.66	0.90	1.95	0.10
0.31	0.84	0.39	1.06	0.65	0.91	1.94	0.11
0.32	0.83	0.38	1.07	0.64	0.91	1.99	0.09
0.33	0.85	0.39	1.06	0.64	0.89	1.96	0.10
0.32	0.83	0.38	1.06	0.64	0.91	1.93	0.09
0.31	0.82	0.39	1.08	0.65	0.91	1.95	0.09
0.33	0.85	0.39	1.07	0.64	0.91	1.96	0.09
0.32	0.84	0.39	1.06	0.66	0.92	1.93	0.09
0.32	0.84	0.38	1.06	0.65	0.91	1.93	0.09
0.31	0.84	0.39	1.05	0.66	0.90	1.94	0.09
0.33	0.84	0.38	1.06	0.65	0.91	1.91	0.10
0.32	0.83	0.38	1.06	0.66	0.91	1.96	0.09
0.32	0.83	0.38	1.07	0.64	0.92	1.87	0.10
0.31	0.83	0.38	1.06	0.65	0.90	1.95	0.09
0.31	0.83	0.39	1.05	0.64	0.91	1.89	0.09
0.31	0.82	0.38	1.05	0.66	0.91	1.93	0.09
0.32	0.83	0.38	1.07	0.66	0.92	1.95	0.09
0.32	0.83	0.38	1.08	0.65	0.90	1.87	0.09
0.33	0.84	0.38	1.05	0.65	0.91	1.93	0.09
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.32	0.84	0.38	1.06	0.65	0.91	1.94	0.09
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01

Table 51: The visual filtered densities (subtracted out the paper densities) of the CMYK sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.22	0.75	0.29	0.98	0.55	0.83	1.85
0.23	0.74	0.29	0.96	0.55	0.82	1.88
0.28	0.74	0.29	0.96	0.55	0.83	1.86
0.23	0.74	0.30	0.95	0.56	0.81	1.87
0.20	0.73	0.26	0.92	0.53	0.79	1.83
0.22	0.75	0.29	0.96	0.55	0.80	1.83
0.21	0.73	0.29	0.95	0.54	0.81	1.85
0.23	0.75	0.29	0.95	0.55	0.82	1.86
0.25	0.76	0.29	0.98	0.56	0.84	1.9
0.22	0.75	0.30	0.97	0.56	0.83	1.85
0.23	0.75	0.29	0.96	0.56	0.82	1.87
0.23	0.72	0.28	0.95	0.56	0.80	1.85
0.20	0.73	0.28	0.95	0.54	0.80	1.83
0.23	0.74	0.29	0.98	0.55	0.82	1.9
0.23	0.75	0.29	0.96	0.54	0.79	1.86
0.23	0.74	0.29	0.97	0.55	0.82	1.84
0.22	0.73	0.30	0.99	0.56	0.82	1.86
0.24	0.76	0.30	0.98	0.55	0.82	1.87
0.23	0.75	0.30	0.97	0.57	0.83	1.84
0.23	0.75	0.29	0.97	0.56	0.82	1.84
0.22	0.75	0.30	0.96	0.57	0.81	1.85
0.23	0.74	0.28	0.96	0.55	0.81	1.81
0.23	0.74	0.29	0.97	0.57	0.82	1.87
0.22	0.73	0.28	0.97	0.54	0.82	1.77
0.22	0.74	0.29	0.97	0.56	0.81	1.86
0.22	0.74	0.30	0.96	0.55	0.82	1.8
0.22	0.73	0.29	0.96	0.57	0.82	1.84
0.23	0.74	0.29	0.98	0.57	0.83	1.86
0.23	0.74	0.29	0.99	0.56	0.81	1.78
0.24	0.75	0.29	0.96	0.56	0.82	1.84
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.23	0.74	0.29	0.96	0.55	0.82	1.8473
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.01	0.01	0.01	0.0294

Table 52: The red filtered densities of the KCMY sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.12	0.22	1.33	0.22	1.27	1.25	1.80	0.10
0.12	0.22	1.35	0.22	1.28	1.26	1.82	0.11
0.13	0.23	1.34	0.24	1.27	1.25	1.78	0.10
0.13	0.23	1.36	0.21	1.28	1.23	1.78	0.11
0.13	0.23	1.38	0.22	1.28	1.26	1.76	0.11
0.14	0.23	1.37	0.23	1.30	1.24	1.77	0.11
0.14	0.22	1.36	0.22	1.27	1.26	1.77	0.10
0.12	0.22	1.36	0.21	1.32	1.26	1.77	0.10
0.13	0.22	1.37	0.22	1.29	1.26	1.77	0.11
0.13	0.23	1.37	0.26	1.30	1.26	1.76	0.11
0.13	0.23	1.39	0.24	1.31	1.24	1.79	0.11
0.13	0.23	1.35	0.22	1.30	1.24	1.75	0.10
0.13	0.22	1.37	0.22	1.29	1.26	1.75	0.11
0.12	0.23	1.39	0.22	1.30	1.27	1.78	0.12
0.13	0.24	1.38	0.22	1.30	1.25	1.76	0.10
0.13	0.22	1.37	0.23	1.29	1.26	1.79	0.10
0.12	0.23	1.43	0.22	1.30	1.26	1.79	0.11
0.13	0.23	1.38	0.23	1.30	1.25	1.79	0.11
0.13	0.23	1.39	0.23	1.30	1.28	1.78	0.11
0.13	0.23	1.39	0.22	1.31	1.25	1.78	0.12
0.13	0.23	1.39	0.23	1.30	1.24	1.80	0.11
0.13	0.23	1.39	0.23	1.29	1.26	1.76	0.11
0.14	0.23	1.38	0.23	1.30	1.26	1.74	0.11
0.13	0.23	1.37	0.24	1.29	1.26	1.78	0.11
0.13	0.23	1.39	0.25	1.30	1.26	1.76	0.11
0.13	0.25	1.41	0.24	1.30	1.25	1.76	0.11
0.14	0.23	1.37	0.24	1.30	1.25	1.75	0.11
0.14	0.23	1.39	0.23	1.30	1.25	1.79	0.11
0.13	0.25	1.42	0.22	1.29	1.26	1.75	0.11
0.13	0.23	1.41	0.23	1.29	1.26	1.80	0.11
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.13	0.23	1.38	0.23	1.29	1.25	1.77	0.11
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.01

Table 53: The red filtered densities (subtracted out the paper densities) of the KCMY sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.02	0.12	1.23	0.12	1.17	1.15	1.70
0.01	0.11	1.24	0.11	1.17	1.15	1.71
0.03	0.13	1.24	0.14	1.17	1.15	1.68
0.02	0.12	1.25	0.10	1.17	1.12	1.67
0.02	0.12	1.27	0.11	1.17	1.15	1.65
0.03	0.12	1.26	0.12	1.19	1.13	1.66
0.04	0.12	1.26	0.12	1.17	1.16	1.67
0.02	0.12	1.26	0.11	1.22	1.16	1.67
0.02	0.11	1.26	0.11	1.18	1.15	1.66
0.02	0.12	1.26	0.15	1.19	1.15	1.65
0.02	0.12	1.28	0.13	1.20	1.13	1.68
0.03	0.13	1.25	0.12	1.20	1.14	1.65
0.02	0.11	1.26	0.11	1.18	1.15	1.64
0.00	0.11	1.27	0.10	1.18	1.15	1.66
0.03	0.14	1.28	0.12	1.20	1.15	1.66
0.03	0.12	1.27	0.13	1.19	1.16	1.69
0.01	0.12	1.32	0.11	1.19	1.15	1.68
0.02	0.12	1.27	0.12	1.19	1.14	1.68
0.02	0.12	1.28	0.12	1.19	1.17	1.67
0.01	0.11	1.27	0.10	1.19	1.13	1.66
0.02	0.12	1.28	0.12	1.19	1.13	1.69
0.02	0.12	1.28	0.12	1.18	1.15	1.65
0.03	0.12	1.27	0.12	1.19	1.15	1.63
0.02	0.12	1.26	0.13	1.18	1.15	1.67
0.02	0.12	1.28	0.14	1.19	1.15	1.65
0.02	0.14	1.30	0.13	1.19	1.14	1.65
0.03	0.12	1.26	0.13	1.19	1.14	1.64
0.03	0.12	1.28	0.12	1.19	1.14	1.68
0.02	0.14	1.31	0.11	1.18	1.15	1.64
0.02	0.12	1.30	0.12	1.18	1.15	1.69
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.02	0.12	1.27	0.12	1.19	1.15	1.67
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.02	0.01	0.01	0.01	0.02

Table 54: The green filtered densities of the KCMY sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.15	1.23	0.48	1.16	0.52	1.29	1.83	0.09
0.16	1.23	0.49	1.19	0.52	1.31	1.83	0.11
0.15	1.25	0.48	1.19	0.52	1.32	1.80	0.09
0.16	1.24	0.49	1.11	0.52	1.26	1.81	0.10
0.15	1.22	0.50	1.16	0.52	1.30	1.81	0.09
0.16	1.21	0.51	1.15	0.54	1.28	1.81	0.11
0.16	1.21	0.49	1.18	0.52	1.31	1.80	0.09
0.16	1.20	0.49	1.16	0.56	1.28	1.80	0.09
0.18	1.21	0.50	1.16	0.53	1.29	1.80	0.10
0.15	1.21	0.49	1.17	0.53	1.26	1.80	0.10
0.15	1.19	0.50	1.17	0.52	1.30	1.81	0.10
0.15	1.21	0.49	1.16	0.53	1.29	1.79	0.09
0.15	1.21	0.49	1.17	0.52	1.27	1.79	0.10
0.14	1.23	0.49	1.16	0.52	1.26	1.80	0.11
0.16	1.23	0.50	1.17	0.53	1.30	1.79	0.10
0.16	1.22	0.49	1.17	0.53	1.29	1.81	0.09
0.15	1.28	0.51	1.19	0.53	1.34	1.83	0.10
0.16	1.25	0.50	1.18	0.53	1.32	1.83	0.10
0.15	1.27	0.50	1.19	0.53	1.34	1.82	0.10
0.15	1.25	0.51	1.18	0.53	1.30	1.80	0.10
0.15	1.26	0.51	1.19	0.54	1.32	1.83	0.10
0.15	1.24	0.50	1.20	0.53	1.31	1.79	0.09
0.16	1.21	0.51	1.17	0.53	1.31	1.77	0.10
0.15	1.26	0.49	1.21	0.53	1.33	1.80	0.10
0.15	1.26	0.50	1.21	0.53	1.32	1.80	0.09
0.15	1.27	0.50	1.20	0.53	1.33	1.79	0.10
0.16	1.22	0.50	1.20	0.53	1.30	1.78	0.09
0.16	1.20	0.50	1.18	0.53	1.29	1.81	0.09
0.15	1.22	0.51	1.16	0.53	1.29	1.78	0.10
0.15	1.20	0.50	1.19	0.52	1.27	1.83	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.15	1.23	0.50	1.18	0.53	1.30	1.80	0.10
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.02	0.01

Table 55: The green filtered densities (subtracted out the paper densities) of the KCMY sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.06	1.14	0.39	1.07	0.43	1.20	1.74
0.05	1.12	0.38	1.08	0.41	1.20	1.72
0.06	1.16	0.39	1.10	0.43	1.23	1.71
0.06	1.14	0.39	1.01	0.42	1.16	1.71
0.06	1.13	0.41	1.07	0.43	1.21	1.72
0.05	1.10	0.40	1.04	0.43	1.17	1.70
0.07	1.12	0.40	1.09	0.43	1.22	1.71
0.07	1.11	0.40	1.07	0.47	1.19	1.71
0.08	1.11	0.40	1.06	0.43	1.19	1.70
0.05	1.11	0.39	1.07	0.43	1.16	1.70
0.05	1.09	0.40	1.07	0.42	1.20	1.71
0.06	1.12	0.40	1.07	0.44	1.20	1.70
0.05	1.11	0.39	1.07	0.42	1.17	1.69
0.03	1.12	0.38	1.05	0.41	1.15	1.69
0.06	1.13	0.40	1.07	0.43	1.20	1.69
0.07	1.13	0.40	1.08	0.44	1.20	1.72
0.05	1.18	0.41	1.09	0.43	1.24	1.73
0.06	1.15	0.40	1.08	0.43	1.22	1.73
0.05	1.17	0.40	1.09	0.43	1.24	1.72
0.05	1.15	0.41	1.08	0.43	1.20	1.70
0.05	1.16	0.41	1.09	0.44	1.22	1.73
0.06	1.15	0.41	1.11	0.44	1.22	1.70
0.06	1.11	0.41	1.07	0.43	1.21	1.67
0.05	1.16	0.39	1.11	0.43	1.23	1.70
0.06	1.17	0.41	1.12	0.44	1.23	1.71
0.05	1.17	0.40	1.10	0.43	1.23	1.69
0.07	1.13	0.41	1.11	0.44	1.21	1.69
0.07	1.11	0.41	1.09	0.44	1.20	1.72
0.05	1.12	0.41	1.06	0.43	1.19	1.68
0.05	1.10	0.40	1.09	0.42	1.17	1.73
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.06	1.13	0.40	1.08	0.43	1.20	1.71
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.02	0.01	0.02	0.02

Table 56: The blue filtered densities of the KCMY sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
1.12	0.67	0.20	1.50	0.96	0.64	1.83	0.10
1.15	0.68	0.21	1.52	0.96	0.65	1.86	0.10
1.15	0.69	0.21	1.52	0.97	0.66	1.84	0.10
1.13	0.67	0.20	1.48	0.95	0.63	1.85	0.12
1.16	0.67	0.22	1.48	0.96	0.66	1.85	0.09
1.13	0.67	0.22	1.49	0.96	0.65	1.86	0.11
1.13	0.67	0.21	1.49	0.95	0.66	1.84	0.10
1.14	0.67	0.21	1.50	0.97	0.65	1.82	0.10
1.14	0.67	0.21	1.52	0.96	0.65	1.84	0.10
1.12	0.67	0.22	1.48	0.94	0.63	1.85	0.11
1.13	0.66	0.21	1.51	0.95	0.65	1.87	0.11
1.14	0.66	0.22	1.49	0.95	0.64	1.82	0.10
1.14	0.66	0.21	1.50	0.94	0.63	1.83	0.11
1.13	0.67	0.21	1.49	0.93	0.64	1.85	0.11
1.13	0.67	0.23	1.50	0.93	0.66	1.85	0.11
1.13	0.67	0.21	1.51	0.97	0.65	1.87	0.11
1.13	0.71	0.23	1.52	0.98	0.68	1.88	0.11
1.13	0.69	0.22	1.50	0.94	0.68	1.86	0.12
1.13	0.69	0.22	1.53	0.98	0.67	1.87	0.11
1.14	0.68	0.21	1.49	0.94	0.65	1.85	0.11
1.14	0.71	0.22	1.53	0.98	0.66	1.86	0.11
1.14	0.68	0.21	1.51	0.96	0.66	1.83	0.10
1.11	0.67	0.21	1.50	0.93	0.66	1.81	0.10
1.14	0.69	0.21	1.53	0.95	0.67	1.86	0.10
1.12	0.69	0.22	1.50	0.94	0.67	1.85	0.10
1.15	0.69	0.21	1.51	0.92	0.67	1.83	0.10
1.14	0.67	0.21	1.52	0.95	0.66	1.83	0.10
1.13	0.66	0.22	1.47	0.95	0.65	1.85	0.11
1.14	0.67	0.22	1.51	0.94	0.65	1.83	0.11
1.14	0.66	0.22	1.51	0.97	0.64	1.88	0.10
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.13	0.68	0.21	1.50	0.95	0.65	1.85	0.11
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.01

Table 57: The blue filtered densities (subtracted out the paper densities) of the KCMY sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
1.02	0.57	0.10	1.40	0.86	0.54	1.73
1.05	0.58	0.11	1.42	0.86	0.55	1.76
1.05	0.59	0.11	1.42	0.87	0.56	1.74
1.01	0.55	0.08	1.36	0.83	0.51	1.73
1.07	0.58	0.13	1.39	0.87	0.57	1.76
1.02	0.56	0.11	1.38	0.85	0.54	1.75
1.03	0.57	0.11	1.39	0.85	0.56	1.74
1.04	0.57	0.11	1.40	0.87	0.55	1.72
1.04	0.57	0.11	1.42	0.86	0.55	1.74
1.01	0.56	0.11	1.37	0.83	0.52	1.74
1.02	0.55	0.10	1.40	0.84	0.54	1.76
1.04	0.56	0.12	1.39	0.85	0.54	1.72
1.03	0.55	0.10	1.39	0.83	0.52	1.72
1.02	0.56	0.10	1.38	0.82	0.53	1.74
1.02	0.56	0.12	1.39	0.82	0.55	1.74
1.02	0.56	0.10	1.40	0.86	0.54	1.76
1.02	0.60	0.12	1.41	0.87	0.57	1.77
1.01	0.57	0.10	1.38	0.82	0.56	1.74
1.02	0.58	0.11	1.42	0.87	0.56	1.76
1.03	0.57	0.10	1.38	0.83	0.54	1.74
1.03	0.60	0.11	1.42	0.87	0.55	1.75
1.04	0.58	0.11	1.41	0.86	0.56	1.73
1.01	0.57	0.11	1.40	0.83	0.56	1.71
1.04	0.59	0.11	1.43	0.85	0.57	1.76
1.02	0.59	0.12	1.40	0.84	0.57	1.75
1.05	0.59	0.11	1.41	0.82	0.57	1.73
1.04	0.57	0.11	1.42	0.85	0.56	1.73
1.02	0.55	0.11	1.36	0.84	0.54	1.74
1.03	0.56	0.11	1.40	0.83	0.54	1.72
1.04	0.56	0.12	1.41	0.87	0.54	1.78
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
1.03	0.57	0.11	1.40	0.85	0.55	1.74
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.01	0.01	0.02	0.02	0.02	0.02

Table 58: The visual filtered densities of the KCMY sequence

YELL...	MAG...	CYAN	RED	GREEN	BLUE	BLACK	WHITE
0.31	0.85	0.36	1.07	0.66	0.95	1.81	0.09
0.32	0.84	0.36	1.10	0.66	0.95	1.85	0.08
0.32	0.86	0.36	1.09	0.66	0.95	1.80	0.09
0.31	0.85	0.37	1.04	0.65	0.92	1.81	0.09
0.31	0.84	0.38	1.06	0.65	0.94	1.78	0.08
0.32	0.83	0.37	1.08	0.67	0.93	1.82	0.08
0.33	0.84	0.36	1.08	0.65	0.95	1.88	0.08
0.31	0.82	0.36	1.06	0.69	0.92	1.79	0.07
. 0.32	0.83	0.37	1.07	0.66	0.93	1.79	0.08
0.32	0.82	0.37	1.10	0.65	0.91	1.81	0.10
0.34	0.83	0.37	1.08	0.66	0.93	1.81	0.09
0.31	0.83	0.37	1.06	0.66	0.93	1.77	0.08
0.32	0.83	0.37	1.07	0.66	0.92	1.77	0.09
0.31	0.84	0.37	1.06	0.66	0.92	1.81	0.08
0.31	0.84	0.37	1.07	0.65	0.94	1.78	0.09
0.31	0.84	0.37	1.07	0.66	0.96	1.80	0.08
0.31	0.88	0.38	1.09	0.66	0.97	1.82	0.08
0.31	0.86	0.37	1.08	0.65	0.96	1.81	0.09
0.31	0.86	0.38	1.09	0.67	0.96	1.81	0.09
0.31	0.85	0.38	1.07	0.66	0.94	1.80	0.08
0.32	0.87	0.37	1.08	0.66	0.96	1.81	0.09
0.31	0.85	0.37	1.09	0.66	0.95	1.77	0.09
0.32	0.84	0.37	1.09	0.65	0.95	1.76	0.08
0.32	0.86	0.37	1.10	0.66	0.96	1.80	0.08
0.31	0.86	0.38	1.09	0.66	0.96	1.79	0.08
0.32	0.88	0.38	1.09	0.66	0.96	1.76	0.08
0.32	0.85	0.37	1.10	0.66	0.94	1.77	0.09
0.32	0.84	0.37	1.07	0.66	0.93	1.81	0.08
0.32	0.85	0.38	1.07	0.66	0.95	1.77	0.08
0.35	0.83	0.37	1.07	0.66	0.92	1.82	0.08
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.32	0.85	0.37	1.08	0.66	0.94	1.80	0.08
STD=	STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.01	0.01	0.02	0.03	0.01

Table 59: The visual filtered densities (subtracted out the paper densities) of the KCMY sequence

Y-Wt	M-Wt	C-Wt	R-Wt	G-Wt	B-Wt	K-Wt
0.22	0.76	0.27	0.98	0.57	0.86	1.72
0.24	0.76	0.28	1.02	0.58	0.87	1.77
0.23	0.77	0.27	1.00	0.57	0.86	1.71
0.22	0.76	0.28	0.95	0.56	0.83	1.72
0.23	0.76	0.30	0.98	0.57	0.86	1.70
0.24	0.75	0.29	1.00	0.59	0.85	1.74
0.25	0.76	0.28	1.00	0.57	0.87	1.80
0.24	0.75	0.29	0.99	0.62	0.85	1.72
0.24	0.75	0.29	0.99	0.58	0.85	1.71
0.22	0.72	0.27	1.00	0.55	0.81	1.71
0.25	0.74	0.28	0.99	0.57	0.84	1.72
0.23	0.75	0.29	0.98	0.58	0.85	1.69
0.23	0.74	0.28	0.98	0.57	0.83	1.68
0.23	0.76	0.29	0.98	0.58	0.84	1.73
0.22	0.75	0.28	0.98	0.56	0.85	1.69
0.23	0.76	0.29	0.99	0.58	0.88	1.72
0.23	0.80	0.30	1.01	0.58	0.89	1.74
0.22	0.77	0.28	0.99	0.56	0.87	1.72
0.22	0.77	0.29	1.00	0.58	0.87	1.72
0.23	0.77	0.30	0.99	0.58	0.86	1.72
0.23	0.78	0.28	0.99	0.57	0.87	1.72
0.22	0.76	0.28	1.00	0.57	0.86	1.68
0.24	0.76	0.29	1.01	0.57	0.87	1.68
0.24	0.78	0.29	1.02	0.58	0.88	1.72
0.23	0.78	0.30	1.01	0.58	0.88	1.71
0.24	0.80	0.30	1.01	0.58	0.88	1.68
0.23	0.76	0.28	1.01	0.57	0.85	1.68
0.24	0.76	0.29	0.99	0.58	0.85	1.73
0.24	0.77	0.30	0.99	0.58	0.87	1.69
0.27	0.75	0.29	0.99	0.58	0.84	1.74
Mean=	Mean=	Mean=	Mean=	Mean=	Mean=	Mean=
0.23	0.76	0.29	0.99	0.58	0.86	1.72
STD=	STD=	STD=	STD=	STD=	STD=	STD=
0.01	0.02	0.01	0.01	0.01	0.02	0.03

APPENDIX E

Hue Error, Grayness, and Densitometric Ink Trapping Percentages of the Four Ink Sequences

Table 60: Hue error, grayness, and densitometric ink trapping percentages of the YMCK sequence

	YELLOW	MAGENTA	CYAN	RED	GREEN	BLUE
%HUE E...	3.91	44.75	25.66			
%GRAY...	1.82	11.85	9.28			
%INK TRAP				70.46	86.74	71.91
				(M/Y)	(C/Y)	(C/M)

Table 61: Hue error, grayness, and densitometric ink trapping percentages of the YCMK sequence

	YELLOW	MAGENTA	CYAN	RED	GREEN	BLUE
%HUE E...	1.98	44.29	25.28			
%GRAY...	3.25	11.13	8.02			
%INK TRAP				78.01	79.71	69.99
				(M/Y)	(C/Y)	(M/C)

Table 62: Hue error, grayness, and densitometric ink trapping percentages of the CMYK sequence

	YELLOW	MAGENTA	CYAN	RED	GREEN	BLUE
%HUE E...	3.62	44.14	25.00			
%GRAY...	1.83	11.23	8.64			
%INK TRAP				79.11	68.76	66.67
				(Y/M)	(Y/C)	(M/C)

Table 63: Hue error, grayness, and densitometric ink trapping percentages of the KCMY sequence

	YELLOW	MAGENTA	CYAN	RED	GREEN	BLUE
%HUE E...	3.47	44.51	25.06			
%GRAY...	2.14	10.69	8.58			
%INK TRAP				80.29	71.65	70.85
				(Y/M)	(Y/C)	(M/C)

APPENDIX F

The Expected L* a* b* Values of the Red, Green, and Blue Patches of the Four Ink Sequences. (Calculated from the Filtered Density Values.)

The Calculation of L* a* b* Expected for the YMCK Sequence

RED

1. Find the expected reflectance values from the filtered density values

$$Dr = D(Y+M)r + D(Y+M)g + D(Y+M)b$$

$$= (0.018+0.128) + (.056+1.08) + (0.99+0.554)$$

$$= 0.146 + 1.136 + 1.544$$

Since $-\log R = -\log Rr - \log Rg - \log R$

$-\log Rr = 0.146$

$Rr = 0.714$

$-\log Rg = 1.136$

$Rg = 0.073$

$-\log Rb = 1.544$

$Rb = 0.029$

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(M+Y) = 44.6

a* = 50.5

b* = 44.4

Table 64: The expected L* a* b* of the red patch of the YMCK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*Z	S*y
380	0.029	50	0.0002	0	0.0007	2.9E-4	0	0.0010	0
390	0.029	54.6	0.0024	0.0003	0.0105	0.0038	4.75E-4	0.0166	0.0164
400	0.029	82.8	0.0191	0.002	0.086	0.0459	0.0048	0.2065	0.1656
410	0.029	91.5	0.0847	0.0088	0.3894	0.2248	0.0234	1.0333	0.8052
420	0.029	93.4	0.2045	0.0214	0.9725	0.5539	0.0580	2.6341	1.9988
430	0.029	86.7	0.3147	0.0387	1.5535	0.7913	0.0973	3.9060	3.3553
440	0.029	104.9	0.3837	0.0621	1.9673	1.1673	0.1889	5.9847	6.5143
450	0.029	117	0.3707	0.0895	1.9948	1.2578	0.3037	6.7684	10.471
460	0.029	117.8	0.3023	0.1282	1.7454	1.0327	0.4380	5.9626	15.102
470	0.029	114.9	0.1956	0.1852	0.3176	0.6518	0.6171	1.0583	21.279
480	0.029	115.9	0.0805	0.2536	0.7721	0.2706	0.8524	2.5951	29.392
490	0.029	108.8	0.0162	0.3391	0.4153	0.0511	1.0699	1.3104	36.894
500	0.029	109.4	0.0038	0.4608	0.2185	0.0121	1.4619	0.6932	50.412
510	0.073	107.8	0.0375	0.6067	0.112	0.2951	4.7744	0.8814	65.402
520	0.073	104.8	0.1177	0.7618	0.0607	0.9005	5.8281	0.4644	79.837
530	0.073	107.7	0.2365	0.8752	0.0305	1.8594	6.8809	0.2398	94.259
540	0.073	104.4	0.3768	0.962	0.0137	2.8717	7.3316	0.1044	100.43
550	0.073	104	0.5298	0.9918	0.004	4.0222	7.5297	0.0304	103.15
560	0.073	100	0.7052	0.9973	0	5.1480	7.2803	0	99.73
570	0.073	96.3	0.8787	0.9556	0	6.1772	6.7178	0	92.024
580	0.073	95.8	1.0142	0.8689	0	7.0927	6.0766	0	83.241
590	0.073	88.7	1.1185	0.7774	0	7.2424	5.0337	0	68.955
600	0.073	90	1.124	0.6583	0	7.3847	4.3250	0	59.247
610	0.714	89.6	1.0305	0.528	0	65.926	33.778	0	47.309
620	0.714	87.7	0.8563	0.3981	0	53.620	24.928	0	34.913
630	0.714	83.3	0.6475	0.2835	0	38.511	16.862	0	23.616
640	0.714	83.7	0.4316	0.1798	0	25.793	10.745	0	15.049
650	0.714	80	0.2683	0.1076	0	15.325	6.1461	0	8.608
660	0.714	82.2	0.1526	0.0603	0	8.9562	3.5391	0	4.9567
670	0.714	82.3	0.0813	0.0318	0	4.7774	1.8686	0	2.6171
680	0.714	78.3	0.0409	0.0159	0	2.2866	0.8889	0	1.2450
690	0.714	69.7	0.0199	0.0077	0	0.9903	0.3832	0	0.5367
700	0.714	71.6	0.0096	0.0037	0	0.4908	0.1892	0	0.2649
710	0.714	74.3	0.0046	0.0018	0	0.2440	0.0955	0	0.1337
720	0.714	61.6	0.0022	0.0008	0	0.0968	0.0352	0	0.0493
730	0.714	69.9	0.001	0.0004	0	0.0499	0.0200	0	0.0280
740	0.714	75.1	0.0005	0.0002	0	0.0268	0.0107	0	0.0150
750	0.714	63.6	0.0003	0.0001	0	0.0136	0.0045	0	0.0064
760	0.714	46.4	0.0001	0	0	0.0033	0	0	0
770	0.714	66.8	0.0001	0	0	0.0048	0	0	0
780	0.714	63.4	0	0	0	0	0	0	0
------...	------...	------...	------...	------...	------...	------...	------...	------...	------
					Sum of	266.17	166.39	33.890	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						22.906	14.319	2.9165	
						L*=	a*=	b*=	
						44.69	50.50	44.40	

GREEN

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+Y)r + D(C+Y)g +D(C+Y)b

= (1.207+0.018) + (.393+0.056) + (0.112+0.990)

= 1.225 + 0.449 + 1.102

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.225

Rr = 0.06

-log Rg = 0.449

Rg = 0.36

-log Rb = 1.102

Rb = 0.079

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+Y) = 60.01

a* = -24

b* = 46.0

Table 65: The expected L* a* b* of the green patch of the YMCK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.079	50	0.0002	0	0.0007	7.9E-4	0	0.0028	0
390	0.079	54.6	0.0024	0.0003	0.0105	0.0104	0.0013	0.0453	0.0164
400	0.079	82.8	0.0191	0.002	0.086	0.1249	0.0131	0.5625	0.1656
410	0.079	91.5	0.0847	0.0088	0.3894	0.6123	0.0636	2.8148	0.8052
420	0.079	93.4	0.2045	0.0214	0.9725	1.5089	0.1579	7.1757	1.9988
430	0.079	86.7	0.3147	0.0387	1.5535	2.1555	0.2651	10.640	3.3553
440	0.079	104.9	0.3837	0.0621	1.9673	3.1798	0.5146	16.303	6.5143
450	0.079	117	0.3707	0.0895	1.9948	3.4264	0.8272	18.438	10.471
460	0.079	117.8	0.3023	0.1282	1.7454	2.8133	1.1931	16.243	15.102
470	0.079	114.9	0.1956	0.1852	0.3176	1.7755	1.6811	2.8829	21.279
480	0.079	115.9	0.0805	0.2536	0.7721	0.7371	2.3220	7.0694	29.392
490	0.079	108.8	0.0162	0.3391	0.4153	0.1392	2.9146	3.5696	36.894
500	0.079	109.4	0.0038	0.4608	0.2185	0.0328	3.9825	1.8884	50.412
510	0.36	107.8	0.0375	0.6067	0.112	1.4553	23.545	4.3465	65.402
520	0.36	104.8	0.1177	0.7618	0.0607	4.4406	28.741	2.2901	79.837
530	0.36	107.7	0.2365	0.8752	0.0305	9.1696	33.933	1.1825	94.259
540	0.36	104.4	0.3768	0.962	0.0137	14.162	36.156	0.5149	100.43
550	0.36	104	0.5298	0.9918	0.004	19.836	37.133	0.1498	103.15
560	0.36	100	0.7052	0.9973	0	25.387	35.903	0	99.73
570	0.36	96.3	0.8787	0.9556	0	30.463	33.129	0	92.024
580	0.36	95.8	1.0142	0.8689	0	34.978	29.967	0	83.241
590	0.36	88.7	1.1185	0.7774	0	35.716	24.824	0	68.955
600	0.36	90	1.124	0.6583	0	36.418	21.329	0	59.247
610	0.06	89.6	1.0305	0.528	0	5.5400	2.8385	0	47.309
620	0.06	87.7	0.8563	0.3981	0	4.5059	2.0948	0	34.913
630	0.06	83.3	0.6475	0.2835	0	3.2362	1.4169	0	23.616
640	0.06	83.7	0.4316	0.1798	0	2.1675	0.9030	0	15.049
650	0.06	80	0.2683	0.1076	0	1.2878	0.5165	0	8.608
660	0.06	82.2	0.1526	0.0603	0	0.7526	0.2974	0	4.9567
670	0.06	82.3	0.0813	0.0318	0	0.4015	0.1570	0	2.6171
680	0.06	78.3	0.0409	0.0159	0	0.1921	0.0747	0	1.2450
690	0.06	69.7	0.0199	0.0077	0	0.0832	0.0322	0	0.5367
700	0.06	71.6	0.0096	0.0037	0	0.0412	0.0159	0	0.2649
710	0.06	74.3	0.0046	0.0018	0	0.0205	0.0080	0	0.1337
720	0.06	61.6	0.0022	0.0008	0	0.0081	0.0030	0	0.0493
730	0.06	69.9	0.001	0.0004	0	0.0042	0.0017	0	0.0280
740	0.06	75.1	0.0005	0.0002	0	0.0023	9.01E-4	0	0.0150
750	0.06	63.6	0.0003	0.0001	0	0.0011	3.82E-4	0	0.0064
760	0.06	46.4	0.0001	0	0	2.78E-4	0	0	0
770	0.06	66.8	0.0001	0	0	4.01E-4	0	0	0
780	0.06	63.4	0	0	0	0	0	0	0
------...	------...	------...	------...	------...	------...	------...	------...	------...	------
					Sum of	246.79	326.96	96.120	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						21.237	28.137	8.2717	
						L*=	a*=	b*=	
						60.01	(24.00)	46.00	

BLUE

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+M)r + D(C+M)g +D(C+M)b

= (1.207+0.128) + (.393+1.08) + (0.112+0.554)

= 1.335 + 1.473 + 0.666

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.335

Rr = 0.045

-log Rg = 1.473

Rg = 0.034

-log Rb = 0.666

Rb = 0.216

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+M) = 29.51

a* = 9

b* = -36

Table 66: The expected L* a* b* of the blue patch of the YMCK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.216	50	0.0002	0	0.0007	0.0022	0	0.0076	- 0
390	0.216	54.6	0.0024	0.0003	0.0105	0.0283	0.0035	0.1238	0.0164
400	0.216	82.8	0.0191	0.002	0.086	0.3416	0.0358	1.5381	0.1656
410	0.216	91.5	0.0847	0.0088	0.3894	1.6740	0.1739	7.6961	0.8052
420	0.216	93.4	0.2045	0.0214	0.9725	4.1257	0.4317	19.620	1.9988
430	0.216	86.7	0.3147	0.0387	1.5535	5.8934	0.7247	29.093	3.3553
440	0.216	104.9	0.3837	0.0621	1.9673	8.6940	1.4071	44.576	6.5143
450	0.216	117	0.3707	0.0895	1.9948	9.3683	2.2618	50.413	10.471
460	0.216	117.8	0.3023	0.1282	1.7454	7.6920	3.2620	44.411	15.102
470	0.216	114.9	0.1956	0.1852	0.3176	4.8545	4.5964	7.8823	21.279
480	0.216	115.9	0.0805	0.2536	0.7721	2.0153	6.3487	19.329	29.392
490	0.216	108.8	0.0162	0.3391	0.4153	0.3807	7.9691	9.7599	36.894
500	0.216	109.4	0.0038	0.4608	0.2185	0.0898	10.889	5.1632	50.412
510	0.034	107.8	0.0375	0.6067	0.112	0.1374	2.2237	0.4105	65.402
520	0.034	104.8	0.1177	0.7618	0.0607	0.4194	2.7144	0.2163	79.837
530	0.034	107.7	0.2365	0.8752	0.0305	0.8660	3.2048	0.1117	94.259
540	0.034	104.4	0.3768	0.962	0.0137	1.3375	3.4147	0.0486	100.43
550	0.034	104	0.5298	0.9918	0.004	1.8734	3.5070	0.0141	103.15
560	0.034	100	0.7052	0.9973	0	2.3977	3.3908	0	99.73
570	0.034	96.3	0.8787	0.9556	0	2.8770	3.1288	0	92.024
580	0.034	95.8	1.0142	0.8689	0	3.3035	2.8302	0	83.241
590	0.034	88.7	1.1185	0.7774	0	3.3732	2.3445	0	68.955
600	0.034	90	1.124	0.6583	0	3.4394	2.0144	0	59.247
610	0.046	89.6	1.0305	0.528	0	4.2473	2.1762	0	47.309
620	0.046	87.7	0.8563	0.3981	0	3.4545	1.6060	0	34.913
630	0.046	83.3	0.6475	0.2835	0	2.4811	1.0863	0	23.616
640	0.046	83.7	0.4316	0.1798	0	1.6617	0.6923	0	15.049
650	0.046	80	0.2683	0.1076	0	0.9873	0.3960	0	8.608
660	0.046	82.2	0.1526	0.0603	0	0.5770	0.2280	0	4.9567
670	0.046	82.3	0.0813	0.0318	0	0.3078	0.1204	0	2.6171
680	0.046	78.3	0.0409	0.0159	0	0.1473	0.0573	0	1.2450
690	0.046	69.7	0.0199	0.0077	0	0.0638	0.0247	0	0.5367
700	0.046	71.6	0.0096	0.0037	0	0.0316	0.0122	0	0.2649
710	0.046	74.3	0.0046	0.0018	0	0.0157	0.0062	0	0.1337
720	0.046	61.6	0.0022	0.0008	0	0.0062	0.0023	0	0.0493
730	0.046	69.9	0.001	0.0004	0	0.0032	0.0013	0	0.0280
740	0.046	75.1	0.0005	0.0002	0	0.0017	6.91E-4	0	0.0150
750	0.046	63.6	0.0003	0.0001	0	8.78E-4	2.93E-4	0	0.0064
760	0.046	46.4	0.0001	0	0	2.13E-4	0	0	0
770	0.046	66.8	0.0001	0	0	3.07E-4	0	0	0
780	0.046	63.4	0	0	0	0	0	0	0
------...	------...	------...	------...	------...	------...	------...	------...	------...	------
					Sum of	79.172	73.287	240.41	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						6.8133	6.3068	20.689	
						L*=	a*=	b*=	
						25.11	9.00	(36.00)	

The Calculation of L* a* b* Expected for the YCMK Sequence

RED

1. Find the expected reflectance values from the filtered density values.

Dr = D(Y+M)r + D(Y+M)g +D(Y+M)b

= (0.034+0.125) + (.054+1.123) + (1.045+0.567)

= 0.159 + 1.177 + 1.612

Since -log R = -log Rr-logRg-log Rb

-log Rr = 0.159

Rr = 0.69

-log Rg = 1.177

Rg = 0.067

-log Rb = .77

Rb = 0.17

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(M+Y) = 27.69

a* = 7.5

b* = 31.2

Table 67: The expected L* a* b* of the red patch of the YCMK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*Z	S*y
380	0.024	50	0.0002	0	0.0007	2.4E-4	0	8.4E-4	0
390	0.024	54.6	0.0024	0.0003	0.0105	0.0031	3.93E-4	0.0138	0.0164
400	0.024	82.8	0.0191	0.002	0.086	0.0380	0.0040	0.1709	0.1656
410	0.024	91.5	0.0847	0.0088	0.3894	0.1860	0.0193	0.8551	0.8052
420	0.024	93.4	0.2045	0.0214	0.9725	0.4584	0.0480	2.1800	1.9988
430	0.024	86.7	0.3147	0.0387	1.5535	0.6548	0.0805	3.2325	3.3553
440	0.024	104.9	0.3837	0.0621	1.9673	0.9660	0.1563	4.9529	6.5143
450	0.024	117	0.3707	0.0895	1.9948	1.0409	0.2513	5.6014	10.471
460	0.024	117.8	0.3023	0.1282	1.7454	0.8547	0.3624	4.9346	15.102
470	0.024	114.9	0.1956	0.1852	0.3176	0.5394	0.5107	0.8758	21.279
480	0.024	115.9	0.0805	0.2536	0.7721	0.2239	0.7054	2.1477	29.392
490	0.024	108.8	0.0162	0.3391	0.4153	0.0423	0.8855	1.0844	36.894
500	0.024	109.4	0.0038	0.4608	0.2185	0.0100	1.2099	0.5737	50.412
510	0.017	107.8	0.0375	0.6067	0.112	0.0687	1.1118	0.2053	65.402
520	0.017	104.8	0.1177	0.7618	0.0607	0.2097	1.3572	0.1081	79.837
530	0.017	107.7	0.2365	0.8752	0.0305	0.4330	1.6024	0.0558	94.259
540	0.017	104.4	0.3768	0.962	0.0137	0.6687	1.7074	0.0243	100.43
550	0.017	104	0.5298	0.9918	0.004	0.9367	1.7535	0.0071	103.15
560	0.017	100	0.7052	0.9973	0	1.1988	1.6954	0	99.73
570	0.017	96.3	0.8787	0.9556	0	1.4385	1.5644	0	92.024
580	0.017	95.8	1.0142	0.8689	0	1.6517	1.4151	0	83.241
590	0.017	88.7	1.1185	0.7774	0	1.6866	1.1722	0	68.955
600	0.017	90	1.124	0.6583	0	1.7197	1.0072	0	59.247
610	0.69	89.6	1.0305	0.528	0	63.710	32.643	0	47.309
620	0.69	87.7	0.8563	0.3981	0	51.817	24.090	0	34.913
630	0.69	83.3	0.6475	0.2835	0	37.216	16.295	0	23.616
640	0.69	83.7	0.4316	0.1798	0	24.926	10.384	0	15.049
650	0.69	80	0.2683	0.1076	0	14.810	5.9395	0	8.608
660	0.69	82.2	0.1526	0.0603	0	8.6552	3.4201	0	4.9567
670	0.69	82.3	0.0813	0.0318	0	4.6168	1.8058	0	2.6171
680	0.69	78.3	0.0409	0.0159	0	2.2097	0.8590	0	1.2450
690	0.69	69.7	0.0199	0.0077	0	0.9571	0.3703	0	0.5367
700	0.69	71.6	0.0096	0.0037	0	0.4743	0.1828	0	0.2649
710	0.69	74.3	0.0046	0.0018	0	0.2358	0.0923	0	0.1337
720	0.69	61.6	0.0022	0.0008	0	0.0935	0.0340	0	0.0493
730	0.69	69.9	0.001	0.0004	0	0.0482	0.0193	0	0.0280
740	0.69	75.1	0.0005	0.0002	0	0.0259	0.0104	0	0.0150
750	0.69	63.6	0.0003	0.0001	0	0.0132	0.0044	0	0.0064
760	0.69	46.4	0.0001	0	0	0.0032	0	0	0
770	0.69	66.8	0.0001	0	0	0.0046	0	0	0
780	0.69	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	224.85	114.77	27.024	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						19.350	9.8767	2.3256	
						L*=	a*=	b*=	
						37.62	63.5	36.6	

GREEN

1. Find the expected reflectance values from the filtered density values.

Dr $= D(C+Y)r + D(C+Y)g + D(C+Y)b$

$= (1.247+0.034) + (0.39+0.054) + (0.1+1.045)$

$= 1.281 + 0.444 + 1.145$

Since $-\log R = -\log Rr - \log Rg - \log Rb$

$-\log Rr = 1.28$

$Rr = 0.52$

$-\log Rg = 0.444$

$Rg = 0.36$

$-\log Rb = 1.145$

$Rb = 0.072$

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

$L^*(C+Y) = 59.83$

$a^* = -27.5$

$b^* = 48.0$

Table 68: The expected L* a* b* of the green patch of the YCMK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.072	50	0.0002	0	0.0007	7.2E-4	0	0.0025	0
390	0.072	54.6	0.0024	0.0003	0.0105	0.0094	0.0012	0.0413	0.0164
400	0.072	82.8	0.0191	0.002	0.086	0.1139	0.0119	0.5127	0.1656
410	0.072	91.5	0.0847	0.0088	0.3894	0.5580	0.0580	2.5654	0.8052
420	0.072	93.4	0.2045	0.0214	0.9725	1.3752	0.1439	6.5399	1.9988
430	0.072	86.7	0.3147	0.0387	1.5535	1.9645	0.2416	9.6976	3.3553
440	0.072	104.9	0.3837	0.0621	1.9673	2.8980	0.4690	14.859	6.5143
450	0.072	117	0.3707	0.0895	1.9948	3.1228	0.7539	16.804	10.471
460	0.072	117.8	0.3023	0.1282	1.7454	2.5640	1.0873	14.804	15.102
470	0.072	114.9	0.1956	0.1852	0.3176	1.6182	1.5321	2.6274	21.279
480	0.072	115.9	0.0805	0.2536	0.7721	0.6718	2.1162	6.4430	29.392
490	0.072	108.8	0.0162	0.3391	0.4153	0.1269	2.6564	3.2533	36.894
500	0.072	109.4	0.0038	0.4608	0.2185	0.0299	3.6296	1.7211	50.412
510	0.36	107.8	0.0375	0.6067	0.112	1.4553	23.545	4.3465	65.402
520	0.36	104.8	0.1177	0.7618	0.0607	4.4406	28.741	2.2901	79.837
530	0.36	107.7	0.2365	0.8752	0.0305	9.1696	33.933	1.1825	94.259
540	0.36	104.4	0.3768	0.962	0.0137	14.162	36.156	0.5149	100.43
550	0.36	104	0.5298	0.9918	0.004	19.836	37.133	0.1498	103.15
560	0.36	100	0.7052	0.9973	0	25.387	35.903	0	99.73
570	0.36	96.3	0.8787	0.9556	0	30.463	33.129	0	92.024
580	0.36	95.8	1.0142	0.8689	0	34.978	29.967	0	83.241
590	0.36	88.7	1.1185	0.7774	0	35.716	24.824	0	68.955
600	0.36	90	1.124	0.6583	0	36.418	21.329	0	59.247
610	0.052	89.6	1.0305	0.528	0	4.8013	2.4601	0	47.309
620	0.052	87.7	0.8563	0.3981	0	3.9051	1.8155	0	34.913
630	0.052	83.3	0.6475	0.2835	0	2.8047	1.2280	0	23.616
640	0.052	83.7	0.4316	0.1798	0	1.8785	0.7826	0	15.049
650	0.052	80	0.2683	0.1076	0	1.1161	0.4476	0	8.608
660	0.052	82.2	0.1526	0.0603	0	0.6523	0.2577	0	4.9567
670	0.052	82.3	0.0813	0.0318	0	0.3479	0.1361	0	2.6171
680	0.052	78.3	0.0409	0.0159	0	0.1665	0.0647	0	1.2450
690	0.052	69.7	0.0199	0.0077	0	0.0721	0.0279	0	0.5367
700	0.052	71.6	0.0096	0.0037	0	0.0357	0.0138	0	0.2649
710	0.052	74.3	0.0046	0.0018	0	0.0178	0.0070	0	0.1337
720	0.052	61.6	0.0022	0.0008	0	0.0070	0.0026	0	0.0493
730	0.052	69.9	0.001	0.0004	0	0.0036	0.0015	0	0.0280
740	0.052	75.1	0.0005	0.0002	0	0.0020	7.81E-4	0	0.0150
750	0.052	63.6	0.0003	0.0001	0	9.92E-4	3.31E-4	0	0.0064
760	0.052	46.4	0.0001	0	0	2.41E-4	0	0	0
770	0.052	66.8	0.0001	0	0	3.47E-4	0	0	0
780	0.052	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	242.89	324.61	88.355	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						20.902	27.934	7.6035	
						L*=	a*=	b*=	
						59.83	(27.50)	48.00	

BLUE

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+M)r + D(C+M)g +D(C+M)b

= (1.207+0.128) + (.393+1.08) + (0.112+0.554)

= 1.335 + 1.473 + 0.666

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.335

Rr = 0.046

-log Rg = 1.473

Rg = 0.034

-log Rb = 0.666

Rb = 0.216

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+M) = 29.51

a* = 9

b* = -36

Table 69: The expected L* a* b* of the blue patch of the YCMK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.17	50	0.0002	0	0.0007	0.0017	0	0.0059	0
390	0.17	54.6	0.0024	0.0003	0.0105	0.0223	0.0028	0.0975	0.0164
400	0.17	82.8	0.0191	0.002	0.086	0.2689	0.0282	1.2105	0.1656
410	0.17	91.5	0.0847	0.0088	0.3894	1.3175	0.1369	6.0571	0.8052
420	0.17	93.4	0.2045	0.0214	0.9725	3.2471	0.3398	15.441	1.9988
430	0.17	86.7	0.3147	0.0387	1.5535	4.6384	0.5704	22.897	3.3553
440	0.17	104.9	0.3837	0.0621	1.9673	6.8425	1.1074	35.083	6.5143
450	0.17	117	0.3707	0.0895	1.9948	7.3732	1.7802	39.677	10.471
460	0.17	117.8	0.3023	0.1282	1.7454	6.0539	2.5673	34.953	15.102
470	0.17	114.9	0.1956	0.1852	0.3176	3.8207	3.6175	6.2037	21.279
480	0.17	115.9	0.0805	0.2536	0.7721	1.5861	4.9967	15.213	29.392
490	0.17	108.8	0.0162	0.3391	0.4153	0.2996	6.2720	7.6814	36.894
500	0.17	109.4	0.0038	0.4608	0.2185	0.0707	8.5700	4.0637	50.412
510	0.031	107.8	0.0375	0.6067	0.112	0.1253	2.0275	0.3743	65.402
520	0.031	104.8	0.1177	0.7618	0.0607	0.3824	2.4749	0.1972	79.837
530	0.031	107.7	0.2365	0.8752	0.0305	0.7896	2.9220	0.1018	94.259
540	0.031	104.4	0.3768	0.962	0.0137	1.2195	3.1134	0.0443	100.43
550	0.031	104	0.5298	0.9918	0.004	1.7081	3.1976	0.0129	103.15
560	0.031	100	0.7052	0.9973	0	2.1861	3.0916	0	99.73
570	0.031	96.3	0.8787	0.9556	0	2.6232	2.8528	0	92.024
580	0.031	95.8	1.0142	0.8689	0	3.0120	2.5805	0	83.241
590	0.031	88.7	1.1185	0.7774	0	3.0755	2.1376	0	68.955
600	0.031	90	1.124	0.6583	0	3.1360	1.8367	0	59.247
610	0.042	89.6	1.0305	0.528	0	3.8780	1.9870	0	47.309
620	0.042	87.7	0.8563	0.3981	0	3.1541	1.4664	0	34.913
630	0.042	83.3	0.6475	0.2835	0	2.2653	0.9919	0	23.616
640	0.042	83.7	0.4316	0.1798	0	1.5172	0.6321	0	15.049
650	0.042	80	0.2683	0.1076	0	0.9015	0.3615	0	8.608
660	0.042	82.2	0.1526	0.0603	0	0.5268	0.2082	0	4.9567
670	0.042	82.3	0.0813	0.0318	0	0.2810	0.1099	0	2.6171
680	0.042	78.3	0.0409	0.0159	0	0.1345	0.0523	0	1.2450
690	0.042	69.7	0.0199	0.0077	0	0.0583	0.0225	0	0.5367
700	0.042	71.6	0.0096	0.0037	0	0.0289	0.0111	0	0.2649
710	0.042	74.3	0.0046	0.0018	0	0.0144	0.0056	0	0.1337
720	0.042	61.6	0.0022	0.0008	0	0.0057	0.0021	0	0.0493
730	0.042	69.9	0.001	0.0004	0	0.0029	0.0012	0	0.0280
740	0.042	75.1	0.0005	0.0002	0	0.0016	6.31E-4	0	0.0150
750	0.042	63.6	0.0003	0.0001	0	8.01E-4	2.67E-4	0	0.0064
760	0.042	46.4	0.0001	0	0	1.95E-4	0	0	0
770	0.042	66.8	0.0001	0	0	2.81E-4	0	0	0
780	0.042	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	66.572	62.076	189.31	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						5.7289	5.3421	16.292	
						L*=	a*=	b*=	
						27.69	7.50	(31.20)	

The Calculation of L* a* b* Expected for the CMYK Sequence

RED

1. Find the expected reflectance values from the filtered density values.

Dr = D(Y+M)r + D(Y+M)g +D(Y+M)b

= (0.034+0.123) + (.053+1.095) + (0.986+0.552)

= 0.141 + 1.148 + 1.538

Since -log R = -log Rr-logRg-log Rb

-log Rr = 0.141

Rr = 0.73

-log Rg = 1.148

Rg = 0.07

-log Rb = 1.538

Rb = 0.028

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(M+Y) = 44.46

a* = 51.0

b* = 44.8

Table 70: The expected L* a* b* of the red patch of the CMYK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.028	50	0.0002	0	0.0007	2.8E-4	0	9.8E-4	0
390	0.028	54.6	0.0024	0.0003	0.0105	0.0037	4.59E-4	0.0161	0.0164
400	0.028	82.8	0.0191	0.002	0.086	0.0443	0.0046	0.1994	0.1656
410	0.028	91.5	0.0847	0.0088	0.3894	0.2170	0.0225	0.9976	0.8052
420	0.028	93.4	0.2045	0.0214	0.9725	0.5348	0.0560	2.5433	1.9988
430	0.028	86.7	0.3147	0.0387	1.5535	0.7640	0.0939	3.7713	3.3553
440	0.028	104.9	0.3837	0.0621	1.9673	1.1270	0.1824	5.7784	6.5143
450	0.028	117	0.3707	0.0895	1.9948	1.2144	0.2932	6.5350	10.471
460	0.028	117.8	0.3023	0.1282	1.7454	0.9971	0.4229	5.7570	15.102
470	0.028	114.9	0.1956	0.1852	0.3176	0.6293	0.5958	1.0218	21.279
480	0.028	115.9	0.0805	0.2536	0.7721	0.2612	0.8230	2.5056	29.392
490	0.028	108.8	0.0162	0.3391	0.4153	0.0494	1.0330	1.2652	36.894
500	0.07	109.4	0.0038	0.4608	0.2185	0.0291	3.5288	1.6733	50.412
510	0.07	107.8	0.0375	0.6067	0.112	0.2830	4.5782	0.8452	65.402
520	0.07	104.8	0.1177	0.7618	0.0607	0.8634	5.5886	0.4453	79.837
530	0.07	107.7	0.2365	0.8752	0.0305	1.7830	6.5981	0.2299	94.259
540	0.07	104.4	0.3768	0.962	0.0137	2.7537	7.0303	0.1001	100.43
550	0.07	104	0.5298	0.9918	0.004	3.8569	7.2203	0.0291	103.15
560	0.07	100	0.7052	0.9973	0	4.9364	6.9811	0	99.73
570	0.07	96.3	0.8787	0.9556	0	5.9233	6.4417	0	92.024
580	0.07	95.8	1.0142	0.8689	0	6.8012	5.8268	0	83.241
590	0.07	88.7	1.1185	0.7774	0	6.9448	4.8269	0	68.955
600	0.72	90	1.124	0.6583	0	72.835	42.658	0	59.247
610	0.72	89.6	1.0305	0.528	0	66.480	34.062	0	47.309
620	0.72	87.7	0.8563	0.3981	0	54.070	25.138	0	34.913
630	0.72	83.3	0.6475	0.2835	0	38.834	17.003	0	23.616
640	0.72	83.7	0.4316	0.1798	0	26.010	10.835	0	15.049
650	0.72	80	0.2683	0.1076	0	15.454	6.1978	0	8.608
660	0.72	82.2	0.1526	0.0603	0	9.0315	3.5688	0	4.9567
670	0.72	82.3	0.0813	0.0318	0	4.8175	1.8843	0	2.6171
680	0.72	78.3	0.0409	0.0159	0	2.3058	0.8964	0	1.2450
690	0.72	69.7	0.0199	0.0077	0	0.9987	0.3864	0	0.5367
700	0.72	71.6	0.0096	0.0037	0	0.4949	0.1907	0	0.2649
710	0.72	74.3	0.0046	0.0018	0	0.2461	0.0963	0	0.1337
720	0.72	61.6	0.0022	0.0008	0	0.0976	0.0355	0	0.0493
730	0.72	69.9	0.001	0.0004	0	0.0503	0.0201	0	0.0280
740	0.72	75.1	0.0005	0.0002	0	0.0270	0.0108	0	0.0150
750	0.72	63.6	0.0003	0.0001	0	0.0137	0.0046	0	0.0064
760	0.72	46.4	0.0001	0	0	0.0033	0	0	0
770	0.72	66.8	0.0001	0	0	0.0048	0	0	0
780	0.72	63.4	0	0	0	0	0	0	0
——...	——...	——...	——...	——...	——...	——...	——...	——...	——
					Sum of	331.79	205.14	33.714	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						28.553	17.653	2.9013	
						L*=	a*=	b*=	
						44.46	51.00	44.80	

GREEN

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+Y)r + D(C+Y)g +D(C+Y)b

= (1.261+0.018) + (0.397+0.053) + (0.109+0.986)

= 1.279 + 0.45 + 1.095

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.279

Rr = 0.053

-log Rg = 0.45

Rg = 0.355

-log Rb = 1.095

Rb = 0.08

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+Y) = 59.92

a* = -24.0

b* = 45.4

Table 71: The expected L* a* b* of the green patch of the CMYK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.08	50	0.0002	0	0.0007	0.0008	0	0.0028	0
390	0.08	54.6	0.0024	0.0003	0.0105	0.0105	0.0013	0.0459	0.0164
400	0.08	82.8	0.0191	0.002	0.086	0.1265	0.0132	0.5697	0.1656
410	0.08	91.5	0.0847	0.0088	0.3894	0.6200	0.0644	2.8504	0.8052
420	0.08	93.4	0.2045	0.0214	0.9725	1.5280	0.1599	7.2665	1.9988
430	0.08	86.7	0.3147	0.0387	1.5535	2.1828	0.2684	10.775	3.3553
440	0.08	104.9	0.3837	0.0621	1.9673	3.2200	0.5211	16.510	6.5143
450	0.08	117	0.3707	0.0895	1.9948	3.4698	0.8377	18.671	10.471
460	0.08	117.8	0.3023	0.1282	1.7454	2.8489	1.2082	16.449	15.102
470	0.08	114.9	0.1956	0.1852	0.3176	1.7980	1.7024	2.9194	21.279
480	0.08	115.9	0.0805	0.2536	0.7721	0.7464	2.3514	7.1589	29.392
490	0.08	108.8	0.0162	0.3391	0.4153	0.1410	2.9515	3.6148	36.894
500	0.08	109.4	0.0038	0.4608	0.2185	0.0333	4.0329	1.9123	50.412
510	0.36	107.8	0.0375	0.6067	0.112	1.4553	23.545	4.3465	65.402
520	0.36	104.8	0.1177	0.7618	0.0607	4.4406	28.741	2.2901	79.837
530	0.36	107.7	0.2365	0.8752	0.0305	9.1696	33.933	1.1825	94.259
540	0.36	104.4	0.3768	0.962	0.0137	14.162	36.156	0.5149	100.43
550	0.36	104	0.5298	0.9918	0.004	19.836	37.133	0.1498	103.15
560	0.36	100	0.7052	0.9973	0	25.387	35.903	0	99.73
570	0.36	96.3	0.8787	0.9556	0	30.463	33.129	0	92.024
580	0.36	95.8	1.0142	0.8689	0	34.978	29.967	0	83.241
590	0.36	88.7	1.1185	0.7774	0	35.716	24.824	0	68.955
600	0.36	90	1.124	0.6583	0	36.418	21.329	0	59.247
610	0.05	89.6	1.0305	0.528	0	4.6166	2.3654	0	47.309
620	0.05	87.7	0.8563	0.3981	0	3.7549	1.7457	0	34.913
630	0.05	83.3	0.6475	0.2835	0	2.6968	1.1808	0	23.616
640	0.05	83.7	0.4316	0.1798	0	1.8062	0.7525	0	15.049
650	0.05	80	0.2683	0.1076	0	1.0732	0.4304	0	8.608
660	0.05	82.2	0.1526	0.0603	0	0.6272	0.2478	0	4.9567
670	0.05	82.3	0.0813	0.0318	0	0.3345	0.1309	0	2.6171
680	0.05	78.3	0.0409	0.0159	0	0.1601	0.0622	0	1.2450
690	0.05	69.7	0.0199	0.0077	0	0.0694	0.0268	0	0.5367
700	0.05	71.6	0.0096	0.0037	0	0.0344	0.0132	0	0.2649
710	0.05	74.3	0.0046	0.0018	0	0.0171	0.0067	0	0.1337
720	0.05	61.6	0.0022	0.0008	0	0.0068	0.0025	0	0.0493
730	0.05	69.9	0.001	0.0004	0	0.0035	0.0014	0	0.0280
740	0.05	75.1	0.0005	0.0002	0	0.0019	7.51E-4	0	0.0150
750	0.05	63.6	0.0003	0.0001	0	9.54E-4	3.18E-4	0	0.0064
760	0.05	46.4	0.0001	0	0	2.32E-4	0	0	0
770	0.05	66.8	0.0001	0	0	3.34E-4	0	0	0
780	0.05	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	243.95	325.74	97.229	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						20.994	28.032	8.3672	
						L*=	a*=	b*=	
						59.92	(24.00)	45.40	

BLUE

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+M)r + D(C+M)g +D(C+M)b

= (1.261+0.123) + (.397+1.095) + (0.109+0.552)

= 1.384 + 1.492 + 0.661

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.384

Rr = 0.04

-log Rg = 1.492

Rg = 0.032

-log Rb = 0.661

Rb = 0.22

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+M) = 29.79

a* = 10

b* = -37.2

Table 72: The expected L* a* b* of the blue patch of the CMYK sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.22	50	0.0002	0	0.0007	0.0022	0	0.0077	0
390	0.22	54.6	0.0024	0.0003	0.0105	0.0288	0.0036	0.1261	0.0164
400	0.22	82.8	0.0191	0.002	0.086	0.3479	0.0364	1.5666	0.1656
410	0.22	91.5	0.0847	0.0088	0.3894	1.7050	0.1771	7.8386	0.8052
420	0.22	93.4	0.2045	0.0214	0.9725	4.2021	0.4397	19.983	1.9988
430	0.22	86.7	0.3147	0.0387	1.5535	6.0026	0.7382	29.631	3.3553
440	0.22	104.9	0.3837	0.0621	1.9673	8.8550	1.4331	45.401	6.5143
450	0.22	117	0.3707	0.0895	1.9948	9.5418	2.3037	51.346	10.471
460	0.22	117.8	0.3023	0.1282	1.7454	7.8344	3.3224	45.234	15.102
470	0.22	114.9	0.1956	0.1852	0.3176	4.9444	4.6815	8.0283	21.279
480	0.22	115.9	0.0805	0.2536	0.7721	2.0526	6.4663	19.687	29.392
490	0.22	108.8	0.0162	0.3391	0.4153	0.3878	8.1167	9.9406	36.894
500	0.22	109.4	0.0038	0.4608	0.2185	0.0915	11.091	5.2589	50.412
510	0.032	107.8	0.0375	0.6067	0.112	0.1294	2.0929	0.3864	65.402
520	0.032	104.8	0.1177	0.7618	0.0607	0.3947	2.5548	0.2036	79.837
530	0.032	107.7	0.2365	0.8752	0.0305	0.8151	3.0163	0.1051	94.259
540	0.032	104.4	0.3768	0.962	0.0137	1.2588	3.2138	0.0458	100.43
550	0.032	104	0.5298	0.9918	0.004	1.7632	3.3007	0.0133	103.15
560	0.032	100	0.7052	0.9973	0	2.2566	3.1914	0	99.73
570	0.032	96.3	0.8787	0.9556	0	2.7078	2.9448	0	92.024
580	0.032	95.8	1.0142	0.8689	0	3.1091	2.6637	0	83.241
590	0.032	88.7	1.1185	0.7774	0	3.1748	2.2066	0	68.955
600	0.032	90	1.124	0.6583	0	3.2371	1.8959	0	59.247
610	0.04	89.6	1.0305	0.528	0	3.6933	1.8924	0	47.309
620	0.04	87.7	0.8563	0.3981	0	3.0039	1.3965	0	34.913
630	0.04	83.3	0.6475	0.2835	0	2.1575	0.9446	0	23.616
640	0.04	83.7	0.4316	0.1798	0	1.4450	0.6020	0	15.049
650	0.04	80	0.2683	0.1076	0	0.8586	0.3443	0	8.608
660	0.04	82.2	0.1526	0.0603	0	0.5017	0.1983	0	4.9567
670	0.04	82.3	0.0813	0.0318	0	0.2676	0.1047	0	2.6171
680	0.04	78.3	0.0409	0.0159	0	0.1281	0.0498	0	1.2450
690	0.04	69.7	0.0199	0.0077	0	0.0555	0.0215	0	0.5367
700	0.04	71.6	0.0096	0.0037	0	0.0275	0.0106	0	0.2649
710	0.04	74.3	0.0046	0.0018	0	0.0137	0.0053	0	0.1337
720	0.04	61.6	0.0022	0.0008	0	0.0054	0.0020	0	0.0493
730	0.04	69.9	0.001	0.0004	0	0.0028	0.0011	0	0.0280
740	0.04	75.1	0.0005	0.0002	0	0.0015	6.01E-4	0	0.0150
750	0.04	63.6	0.0003	0.0001	0	7.63E-4	2.54E-4	0	0.0064
760	0.04	46.4	0.0001	0	0	1.86E-4	0	0	0
770	0.04	66.8	0.0001	0	0	2.67E-4	0	0	0
780	0.04	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	77.006	71.464	244.80	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						6.6269	6.1499	21.067	
						L*=	a*=	b*=	
						29.79	10.00	(37.20)	

The Calculation of L* a* b* Expected for the KCMY Sequence

RED

1. Find the expected reflectance values from the filtered density values.

Dr = D(Y+M)r + D(Y+M)g +D(Y+M)b

= (0.022+0.121) + (.057+1.132) + (1.03+0.571)

= 0.143 + 1.189 + 1.601

Since -log R = -log Rr-logRg-log Rb

-log Rr = 0.143

Rr = 0.72

-log Rg = 1.189

Rg = 0.065

-log Rb = 1.601

Rb = 0.025

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(M+Y) = 43.87

a* = 50.0

b* = 46.0

Table 73: The expected L* a* b* of the red patch of the KCMY sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*Z	S*y
380	0.025	50	0.0002	0	0.0007	2.5E-4	0	8.75E-4	0
390	0.025	54.6	0.0024	0.0003	0.0105	0.0033	4.09E-4	0.0143	0.0164
400	0.025	82.8	0.0191	0.002	0.086	0.0395	0.0041	0.1780	0.1656
410	0.025	91.5	0.0847	0.0088	0.3894	0.1938	0.0201	0.8908	0.8052
420	0.025	93.4	0.2045	0.0214	0.9725	0.4775	0.0500	2.2708	1.9988
430	0.025	86.7	0.3147	0.0387	1.5535	0.6821	0.0839	3.3672	3.3553
440	0.025	104.9	0.3837	0.0621	1.9673	1.0063	0.1629	5.1592	6.5143
450	0.025	117	0.3707	0.0895	1.9948	1.0843	0.2618	5.8348	10.471
460	0.025	117.8	0.3023	0.1282	1.7454	0.8903	0.3775	5.1402	15.102
470	0.025	114.9	0.1956	0.1852	0.3176	0.5619	0.5320	0.9123	21.279
480	0.025	115.9	0.0805	0.2536	0.7721	0.2332	0.7348	2.2372	29.392
490	0.025	108.8	0.0162	0.3391	0.4153	0.0441	0.9224	1.1296	36.894
500	0.025	109.4	0.0038	0.4608	0.2185	0.0104	1.2603	0.5976	50.412
510	0.065	107.8	0.0375	0.6067	0.112	0.2628	4.2511	0.7848	65.402
520	0.065	104.8	0.1177	0.7618	0.0607	0.8018	5.1894	0.4135	79.837
530	0.065	107.7	0.2365	0.8752	0.0305	1.6556	6.1268	0.2135	94.259
540	0.065	104.4	0.3768	0.962	0.0137	2.5570	6.5281	0.0930	100.43
550	0.065	104	0.5298	0.9918	0.004	3.5814	6.7046	0.0270	103.15
560	0.065	100	0.7052	0.9973	0	4.5838	6.4824	0	99.73
570	0.065	96.3	0.8787	0.9556	0	5.5002	5.9816	0	92.024
580	0.065	95.8	1.0142	0.8689	0	6.3154	5.4106	0	83.241
590	0.065	88.7	1.1185	0.7774	0	6.4487	4.4821	0	68.955
600	0.065	90	1.124	0.6583	0	6.5754	3.8511	0	59.247
610	0.72	89.6	1.0305	0.528	0	66.480	34.062	0	47.309
620	0.72	87.7	0.8563	0.3981	0	54.070	25.138	0	34.913
630	0.72	83.3	0.6475	0.2835	0	38.834	17.003	0	23.616
640	0.72	83.7	0.4316	0.1798	0	26.010	10.835	0	15.049
650	0.72	80	0.2683	0.1076	0	15.454	6.1978	0	8.608
660	0.72	82.2	0.1526	0.0603	0	9.0315	3.5688	0	4.9567
670	0.72	82.3	0.0813	0.0318	0	4.8175	1.8843	0	2.6171
680	0.72	78.3	0.0409	0.0159	0	2.3058	0.8964	0	1.2450
690	0.72	69.7	0.0199	0.0077	0	0.9987	0.3864	0	0.5367
700	0.72	71.6	0.0096	0.0037	0	0.4949	0.1907	0	0.2649
710	0.72	74.3	0.0046	0.0018	0	0.2461	0.0963	0	0.1337
720	0.72	61.6	0.0022	0.0008	0	0.0976	0.0355	0	0.0493
730	0.72	69.9	0.001	0.0004	0	0.0503	0.0201	0	0.0280
740	0.72	75.1	0.0005	0.0002	0	0.0270	0.0108	0	0.0150
750	0.72	63.6	0.0003	0.0001	0	0.0137	0.0046	0	0.0064
760	0.72	46.4	0.0001	0	0	0.0033	0	0	0
770	0.72	66.8	0.0001	0	0	0.0048	0	0	0
780	0.72	63.4	0	0	0	0	0	0	0
------...	------...	------...	------...	------...	------...	------...	------...	------...	------
					Sum of	262.45	159.75	29.265	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						22.585	13.747	2.5184	
						L*=	a*=	b*=	
						43.87	50.00	46.00	

GREEN

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+Y)r + D(C+Y)g +D(C+Y)b

= (1.27+0.022) + (0.40+0.057) + (0.109+1.03)

= 1.292 + 0.457+ 1.139

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.292

Rr = 0.05

-log Rg = 0.457

Rg = 0.35

-log Rb = 1.139

Rb = 0.073

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+Y) = 59.16

a* = -24.55

b* = 46.60

Table 74: The expected L* a* b* of the green patch of the KCMY sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.073	50	0.0002	0	0.0007	7.3E-4	0	0.0026	.0
390	0.073	54.6	0.0024	0.0003	0.0105	0.0096	0.0012	0.0419	0.0164
400	0.073	82.8	0.0191	0.002	0.086	0.1154	0.0121	0.5198	0.1656
410	0.073	91.5	0.0847	0.0088	0.3894	0.5658	0.0588	2.6010	0.8052
420	0.073	93.4	0.2045	0.0214	0.9725	1.3943	0.1459	6.6307	1.9988
430	0.073	86.7	0.3147	0.0387	1.5535	1.9918	0.2449	9.8323	3.3553
440	0.073	104.9	0.3837	0.0621	1.9673	2.9383	0.4755	15.065	6.5143
450	0.073	117	0.3707	0.0895	1.9948	3.1661	0.7644	17.038	10.471
460	0.073	117.8	0.3023	0.1282	1.7454	2.5996	1.1024	15.009	15.102
470	0.073	114.9	0.1956	0.1852	0.3176	1.6406	1.5534	2.6639	21.279
480	0.073	115.9	0.0805	0.2536	0.7721	0.6811	2.1456	6.5325	29.392
490	0.073	108.8	0.0162	0.3391	0.4153	0.1287	2.6933	3.2985	36.894
500	0.073	109.4	0.0038	0.4608	0.2185	0.0303	3.6800	1.7450	50.412
510	0.35	107.8	0.0375	0.6067	0.112	1.4149	22.891	4.2258	65.402
520	0.35	104.8	0.1177	0.7618	0.0607	4.3172	27.943	2.2265	79.837
530	0.35	107.7	0.2365	0.8752	0.0305	8.9149	32.991	1.1497	94.259
540	0.35	104.4	0.3768	0.962	0.0137	13.768	35.151	0.5006	100.43
550	0.35	104	0.5298	0.9918	0.004	19.285	36.102	0.1456	103.15
560	0.35	100	0.7052	0.9973	0	24.682	34.905	0	99.73
570	0.35	96.3	0.8787	0.9556	0	29.617	32.208	0	92.024
580	0.35	95.8	1.0142	0.8689	0	34.006	29.134	0	83.241
590	0.35	88.7	1.1185	0.7774	0	34.724	24.134	0	68.955
600	0.35	90	1.124	0.6583	0	35.406	20.736	0	59.247
610	0.05	89.6	1.0305	0.528	0	4.6166	2.3654	0	47.309
620	0.05	87.7	0.8563	0.3981	0	3.7549	1.7457	0	34.913
630	0.05	83.3	0.6475	0.2835	0	2.6968	1.1808	0	23.616
640	0.05	83.7	0.4316	0.1798	0	1.8062	0.7525	0	15.049
650	0.05	80	0.2683	0.1076	0	1.0732	0.4304	0	8.608
660	0.05	82.2	0.1526	0.0603	0	0.6272	0.2478	0	4.9567
670	0.05	82.3	0.0813	0.0318	0	0.3345	0.1309	0	2.6171
680	0.05	78.3	0.0409	0.0159	0	0.1601	0.0622	0	1.2450
690	0.05	69.7	0.0199	0.0077	0	0.0694	0.0268	0	0.5367
700	0.05	71.6	0.0096	0.0037	0	0.0344	0.0132	0	0.2649
710	0.05	74.3	0.0046	0.0018	0	0.0171	0.0067	0	0.1337
720	0.05	61.6	0.0022	0.0008	0	0.0068	0.0025	0	0.0493
730	0.05	69.9	0.001	0.0004	0	0.0035	0.0014	0	0.0280
740	0.05	75.1	0.0005	0.0002	0	0.0019	7.51E-4	0	0.0150
750	0.05	63.6	0.0003	0.0001	0	9.54E-4	3.18E-4	0	0.0064
760	0.05	46.4	0.0001	0	0	2.32E-4	0	0	0
770	0.05	66.8	0.0001	0	0	3.34E-4	0	0	0
780	0.05	63.4	0	0	0	0	0	0	0
----...	----...	----...	----...	----...	----...	----...	----...	----...	----
					Sum of	236.60	316.04	89.228	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						20.361	27.197	7.6787	
						L*=	a*=	b*=	
						59.16	(24.55)	46.60	

BLUE

1. Find the expected reflectance values from the filtered density values.

Dr = D(C+M)r + D(C+M)g +D(C+M)b

= (1.27+0.121) + (.393+1.08) + (0.109+0.571)

= 1.391 + 1.532 + 0.68

Since -log R = -log Rr-logRg-log Rb

-log Rr = 1.391

Rr = 0.041

-log Rg = 1.532

Rg = 0.029

-log Rb = 0.68

Rb = 0.21

2. Find the L* a* b* expected from Rr, Rg, and Rb by using the Jazz spreadsheet program.

L*(C+M) = 28.88

a* = 9

b* = -37

Table 75: The expected L* a* b* of the blue patch of the KCMY sequence

Wavel...	O	S	x	y	z	S*O*x	S*O*y	S*O*z	S*y
380	0.21	50	0.0002	0	0.0007	0.0021	0	0.0073	-0
390	0.21	54.6	0.0024	0.0003	0.0105	0.0275	0.0034	0.1204	0.0164
400	0.21	82.8	0.0191	0.002	0.086	0.3321	0.0348	1.4954	0.1656
410	0.21	91.5	0.0847	0.0088	0.3894	1.6275	0.1691	7.4823	0.8052
420	0.21	93.4	0.2045	0.0214	0.9725	4.0111	0.4197	19.075	1.9988
430	0.21	86.7	0.3147	0.0387	1.5535	5.7297	0.7046	28.285	3.3553
440	0.21	104.9	0.3837	0.0621	1.9673	8.4525	1.3680	43.338	6.5143
450	0.21	117	0.3707	0.0895	1.9948	9.1081	2.1990	49.012	10.471
460	0.21	117.8	0.3023	0.1282	1.7454	7.4783	3.1714	43.178	15.102
470	0.21	114.9	0.1956	0.1852	0.3176	4.7196	4.4687	7.6634	21.279
480	0.21	115.9	0.0805	0.2536	0.7721	1.9593	6.1724	18.792	29.392
490	0.21	108.8	0.0162	0.3391	0.4153	0.3701	7.7478	9.4888	36.894
500	0.21	109.4	0.0038	0.4608	0.2185	0.0873	10.586	5.0198	50.412
510	0.029	107.8	0.0375	0.6067	0.112	0.1172	1.8967	0.3501	65.402
520	0.029	104.8	0.1177	0.7618	0.0607	0.3577	2.3153	0.1845	79.837
530	0.029	107.7	0.2365	0.8752	0.0305	0.7387	2.7335	0.0953	94.259
540	0.029	104.4	0.3768	0.962	0.0137	1.1408	2.9126	0.0415	100.43
550	0.029	104	0.5298	0.9918	0.004	1.5979	2.9913	0.0121	103.15
560	0.029	100	0.7052	0.9973	0	2.0451	2.8922	0	99.73
570	0.029	96.3	0.8787	0.9556	0	2.4539	2.6687	0	92.024
580	0.029	95.8	1.0142	0.8689	0	2.8177	2.4140	0	83.241
590	0.029	88.7	1.1185	0.7774	0	2.8771	1.9997	0	68.955
600	0.029	90	1.124	0.6583	0	2.9336	1.7182	0	59.247
610	0.041	89.6	1.0305	0.528	0	3.7856	1.9397	0	47.309
620	0.041	87.7	0.8563	0.3981	0	3.0790	1.4314	0	34.913
630	0.041	83.3	0.6475	0.2835	0	2.2114	0.9682	0	23.616
640	0.041	83.7	0.4316	0.1798	0	1.4811	0.6170	0	15.049
650	0.041	80	0.2683	0.1076	0	0.8800	0.3529	0	8.608
660	0.041	82.2	0.1526	0.0603	0	0.5143	0.2032	0	4.9567
670	0.041	82.3	0.0813	0.0318	0	0.2743	0.1073	0	2.6171
680	0.041	78.3	0.0409	0.0159	0	0.1313	0.0510	0	1.2450
690	0.041	69.7	0.0199	0.0077	0	0.0569	0.0220	0	0.5367
700	0.041	71.6	0.0096	0.0037	0	0.0282	0.0109	0	0.2649
710	0.041	74.3	0.0046	0.0018	0	0.0140	0.0055	0	0.1337
720	0.041	61.6	0.0022	0.0008	0	0.0056	0.0020	0	0.0493
730	0.041	69.9	0.001	0.0004	0	0.0029	0.0011	0	0.0280
740	0.041	75.1	0.0005	0.0002	0	0.0015	6.16E-4	0	0.0150
750	0.041	63.6	0.0003	0.0001	0	7.82E-4	2.61E-4	0	0.0064
760	0.041	46.4	0.0001	0	0	1.90E-4	0	0	0
770	0.041	66.8	0.0001	0	0	2.74E-4	0	0	0
780	0.041	63.4	0	0	0	0	0	0	0
-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----...	-----
					Sum of	73.452	67.301	233.64	1162.0
					K-factor	0.0861			
						X VA...	Y VA...	Z VALUE =	
						6.3210	5.7916	20.106	
						L*=	a*=	b*=	
						28.88	9.00	(37.00)	

APPENDIX G

The Total Color Differences, Chroma Differences, and Hue Angle Differences between the Expected Red, Green, and Blue Patches and the Measured Ones of the Four Sequences

Table 76: The total color differences, chroma differences, and hue angle differences between the expected red, green, and blue patches and the measured ones of the YMCK, YCMK, CMYK, and KCMY sequences

	R (expected)			R (measured)			ΔE*ab	ΔC*ab	ΔH*ab
	L*	a*	b*	L*	a*	b*			
YMCK	44.69	50.5	44.4	53.17	42.45	57.88	17.844	4.5352	15.031
YCMK	37.62	63.5	36.6	49.7	46.3	55.32	28.146	1.1539	25.396
CMYK	44.46	51	44.8	48.62	52.38	45.81	4.4978	1.7035	0.1501
KCMY	43.87	50	46	48.15	53.75	48.11	6.0690	4.1951	0.9571
	G (expected)			G (measured)			ΔE*ab	ΔC*ab	ΔH*ab
	L*	a*	b*	L*	a*	b*			
YMCK	60.01	-24	46	55.76	-57.08	34.91	35.147	15.025	31.489
YCMK	59.83	-27.5	48	56.64	-56.81	37.69	31.234	12.856	28.286
CMYK	59.92	-24	45.4	54.75	-59.2	26.58	40.249	13.540	37.549
KCMY	59.16	-24.55	46.6	54.13	-59.71	29.45	39.442	13.906	36.564
	B (expected)			B (measured)			ΔE*ab	ΔC*ab	ΔH*ab
	L*	a*	b*	L*	a*	b*			
YCMK	29.51	9	-36	32.3	19.34	-39.42	11.243	6.8007	8.5066
YCMK	27.69	7.5	-31.2	32.35	10.46	-41.02	11.265	10.244	0.5074
CMYK	29.79	10	-37.2	34.16	10.87	-41.23	6.0079	4.1182	0.1958
KCMY	28.88	9	-37	32.47	12.67	-41.68	6.9469	5.4843	2.3008

APPENDIX H

The Colorimetric Trapping Percentages

Table 77: The colorimetric trapping percentages

		L*me...	Ymea...	Vmea...	Rm	Dmea...	%TRAP
YMCK	RED	53.170	21.202	4.605	16.404	0.796	64.648
YMCK	GREEN	55.760	23.674	4.866	18.580	0.742	79.615
YMCK	BLUE	32.300	7.219	2.687	5.283	1.288	66.580
YMCK	YELL...	84.150	64.354	8.022	59.491	0.237	
YMCK	MAG...	49.950	18.377	4.287	13.981	0.865	
YMCK	CYAN	61.120	29.385	5.421	23.777	0.635	
YCMK	RED	49.700	18.169	4.262	13.805	0.871	70.935
YCMK	GREEN	56.640	24.556	4.955	19.367	0.724	75.526
YCMK	BLUE	32.350	7.241	2.691	5.299	1.287	61.679
YCMK	YELL...	83.990	64.047	8.003	59.150	0.239	
YCMK	MAG...	48.800	17.432	4.175	13.187	0.891	
YCMK	CYAN	60.750	28.964	5.382	23.387	0.642	
CMYK	RED	48.620	17.287	4.158	13.066	0.895	15.374
CMYK	GREEN	54.750	22.688	4.763	17.707	0.763	55.869
CMYK	BLUE	34.160	8.085	2.843	5.895	1.240	55.514
CMYK	YELL...	84.960	65.929	8.120	61.241	0.224	
CMYK	MAG...	50.180	18.570	4.309	14.144	0.860	
CMYK	CYAN	60.970	29.214	5.405	23.618	0.638	
KCMY	RED	48.150	16.913	4.113	12.754	0.905	13.946
KCMY	GREEN	54.130	22.097	4.701	17.186	0.776	61.691
KCMY	BLUE	32.470	7.295	2.701	5.336	1.284	58.100
KCMY	YELL...	85.030	66.066	8.128	61.394	0.223	
KCMY	MAG...	49.550	18.044	4.248	13.701	0.874	
KCMY	CYAN	60.940	29.180	5.402	23.586	0.638	

APPENDIX I

Inkometer Tack Reading

Table 78: Inkometer tack reading

Company GPI

Type monotack ink

Purpose Tack Measurement

Color Process Yellow 10+ 35386

20 sec. 10.1	1 min. 10.6	6 min. 17.9
1 min. 10.6	2 min. 11.9	7 min. 19.2
	3 min. 13.3	8 min. 20.7
	4 min. 14.8	9 min. 22.3
20 sec. 10.1	5 min. 16.3	10 min. 24.0

Color Process Magenta 10+ 35387

20 sec. 10.6	1 min. 11.3	6 min. 19.8
1 min. 11.3	2 min. 13.0	7 min. 21.6
	3 min. 14.5	8 min. 23.3
	4 min. 16.4	9 min. 25.1
20 sec. 10.6	5 min. 18.1	10 min. 26.8

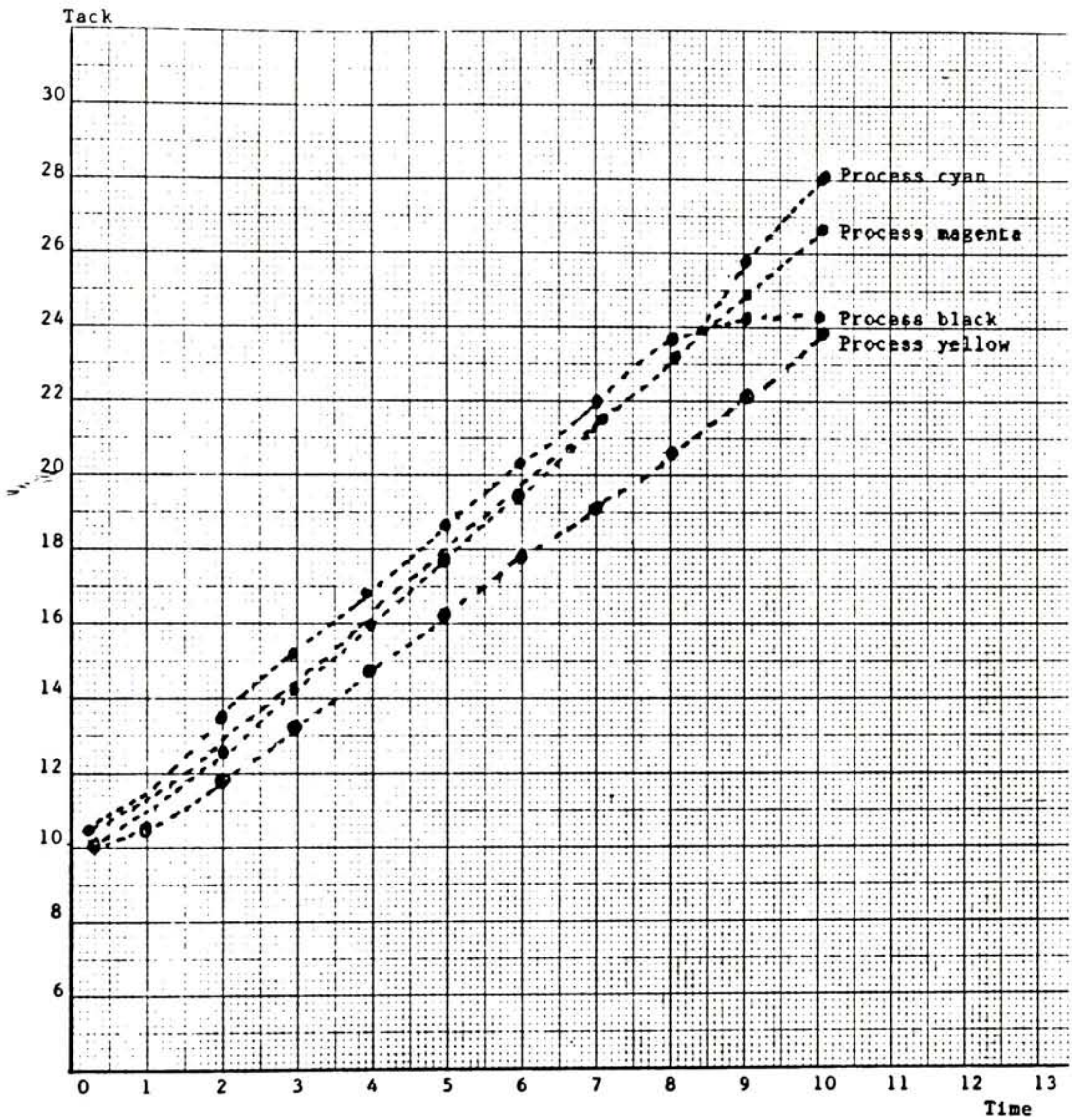
Color Process Cyan 10+ 35388

20 sec. 10.2	1 min. 11.1	6 min. 19.6
1 min. 11.1	2 min. 12.6	7 min. 21.7
	3 min. 14.4	8 min. 23.9
	4 min. 16.1	9 min. 26.0
20 sec. 10.2	5 min. 17.8	10 min. 28.3

Color Process Black 10+ 17980

20 sec.	10.6	1 min.	11.7	6 min.	20.4
1 min.	11.7	2 min.	13.6	7 min.	22.2
		3 min.	15.3	8 min.	23.8
		4 min.	16.9	9 min.	24.4
20 sec.	10.6	5 min.	18.7	10 min.	24.4

Figure 6: Ink tack graph



APPENDIX J.

The Color Patches, the Normal Key, the High Key, the Low Key, and the Skin Tone Pictures Printed by Using the Four Sequences

Figure 7: Color patches printed by using the YMCK sequence

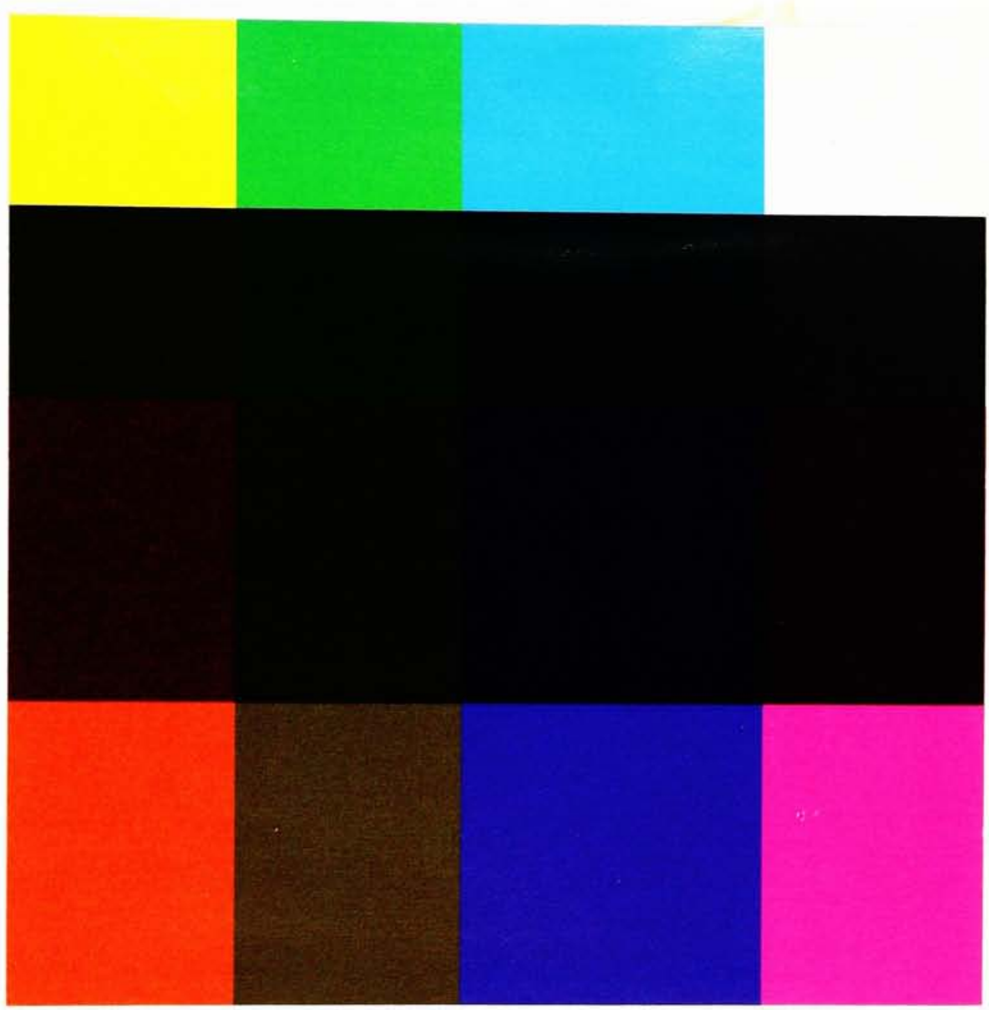


Figure 8 : A normal key picture printed by using the YMCK sequence

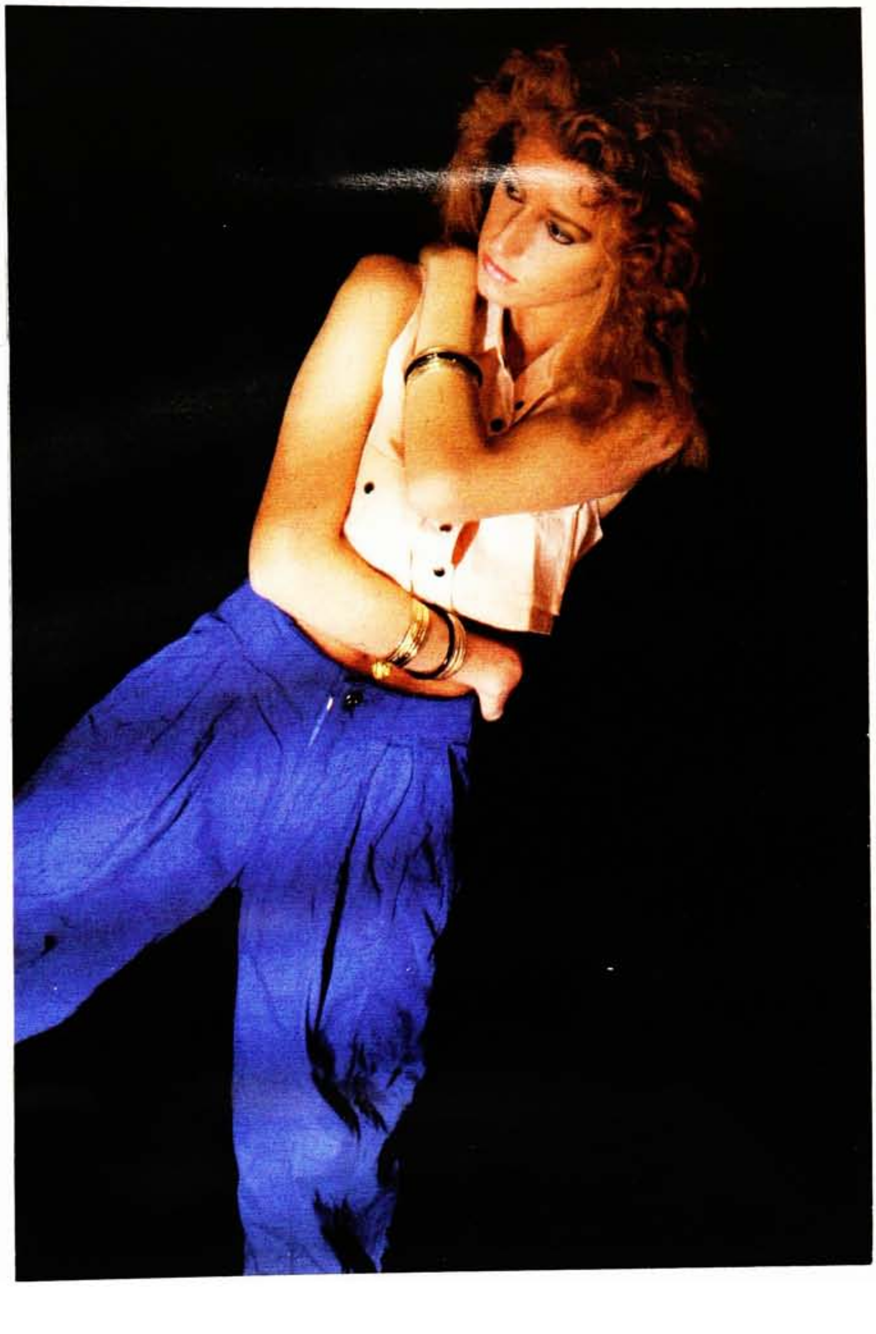


Figure 9: A high key picture printed by using the YMCK sequence

Figure 10: A low key picture printed by using the YMCK sequence

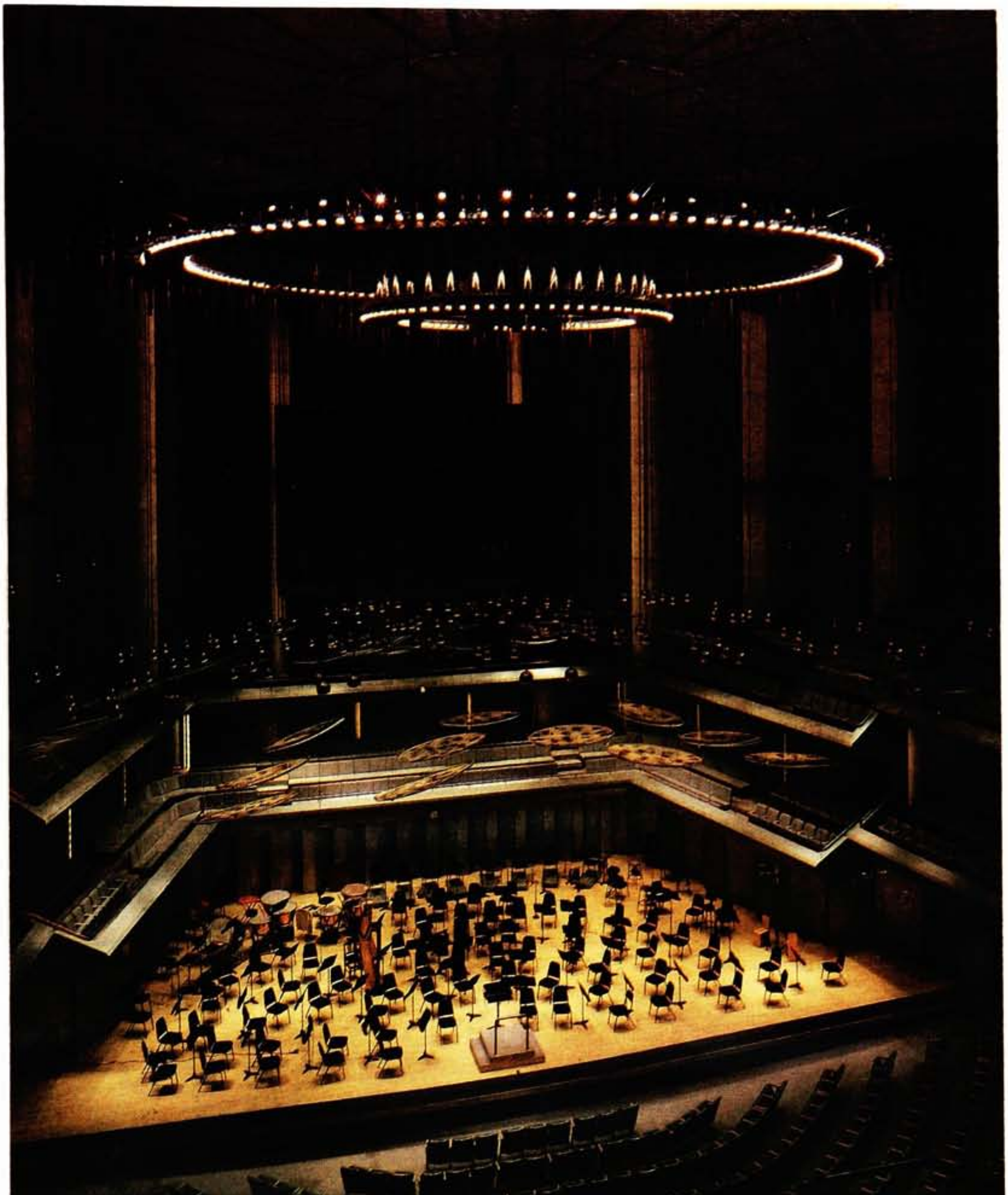


Figure 11: A skin tone picture printed by using the YMCK sequence

Figure 12: Color patches printed by using the YCMK sequence

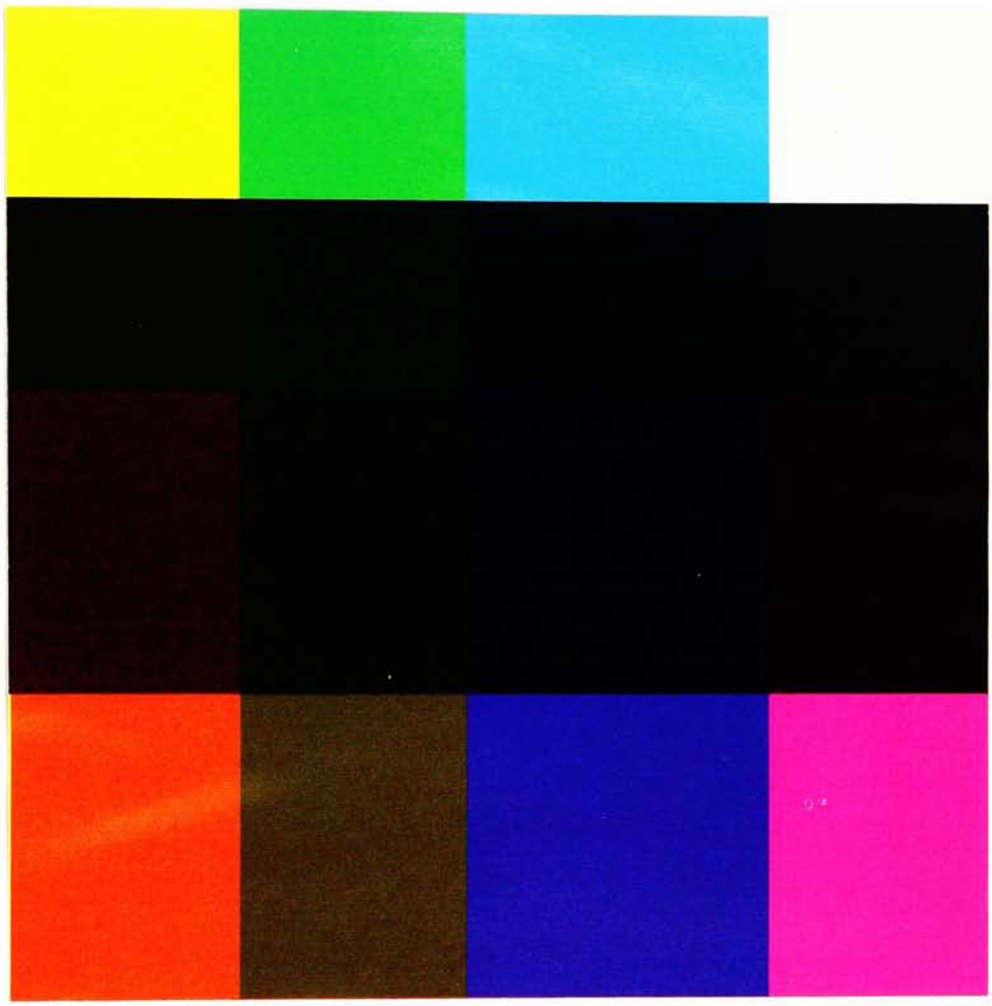


Figure 13 : A normal key picture printed by using the YCMK sequence

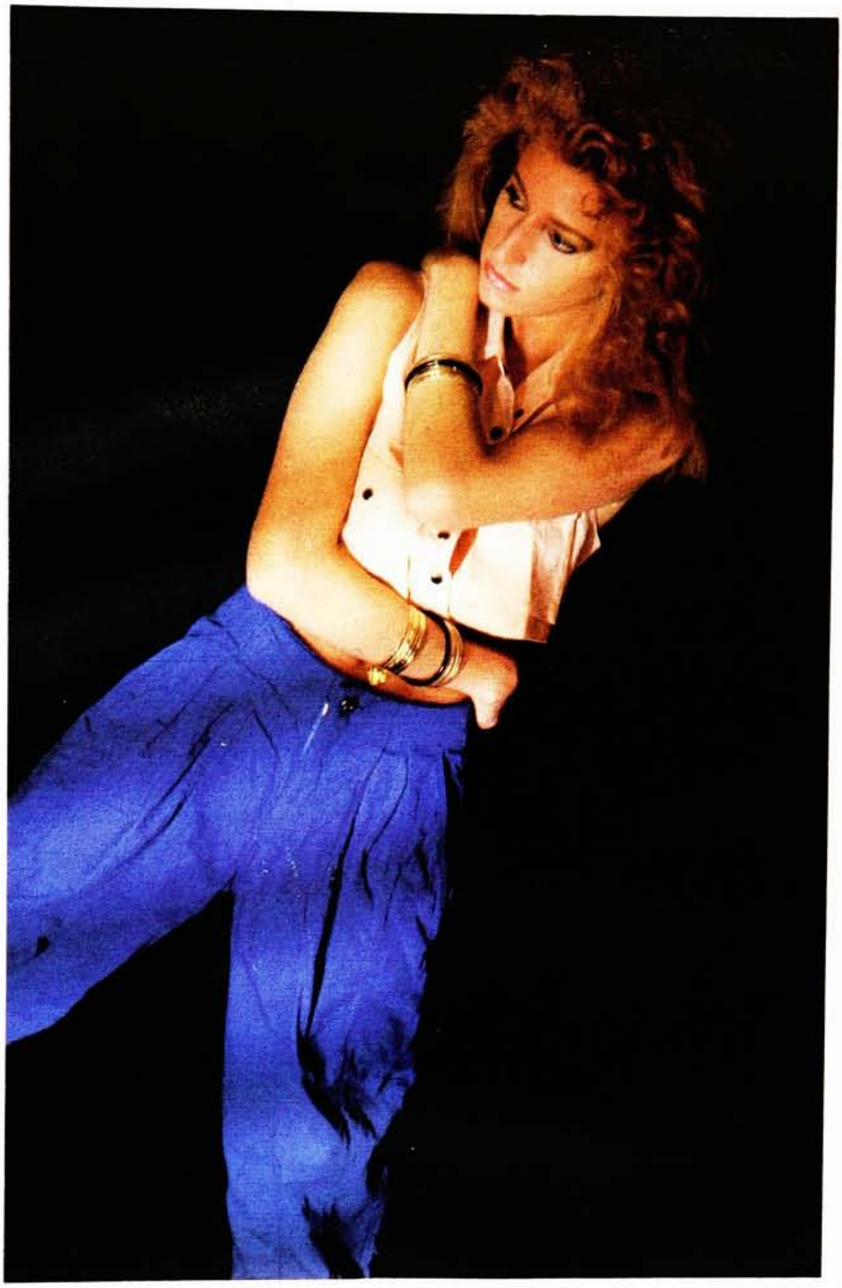


Figure 14: A high key picture printed by using the YCMK sequence

Figure 15: A low key picture printed by using the YCMK sequence

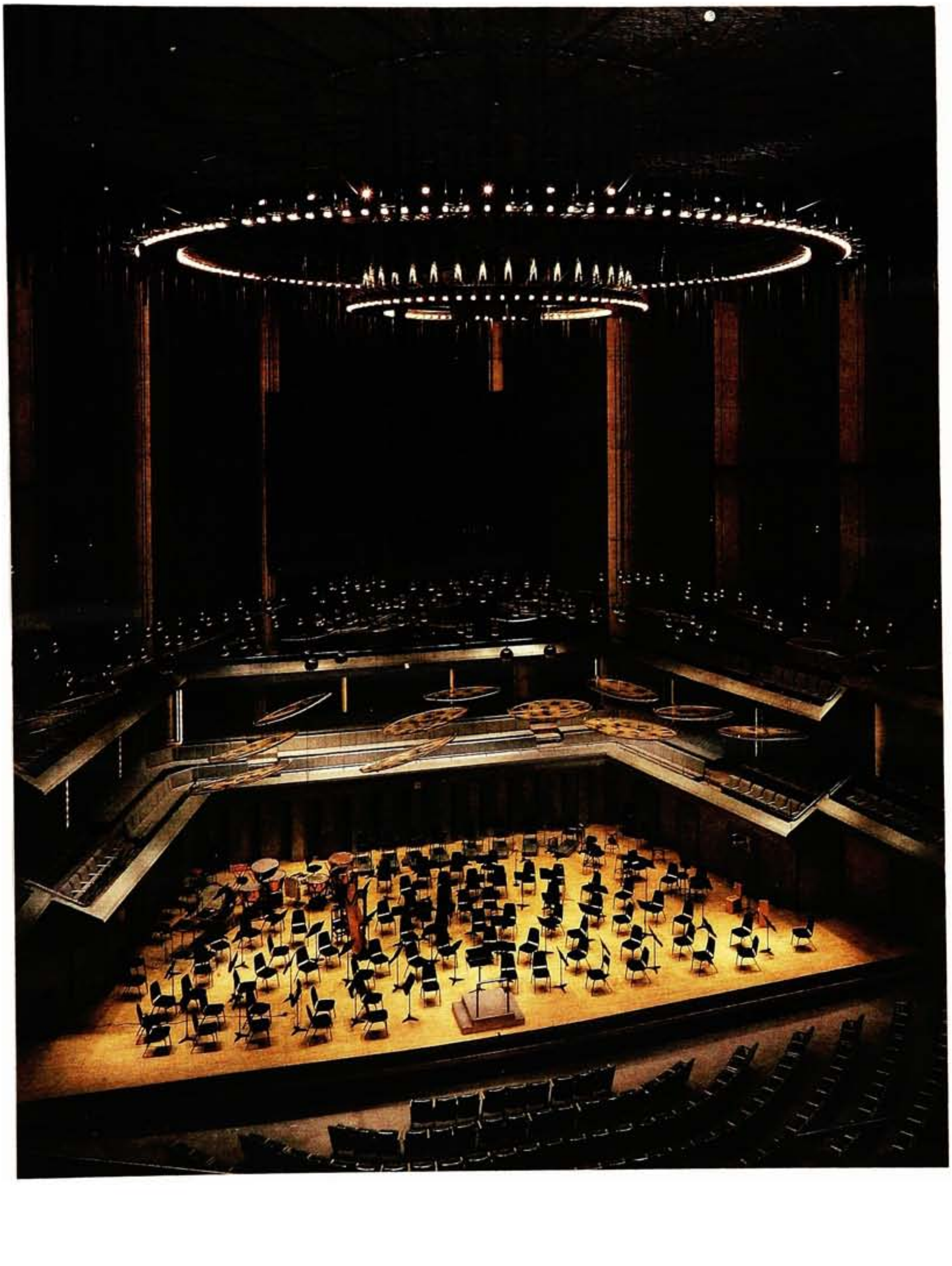


Figure 16: A skin tone picture printed by using the YCMK sequence

Figure 17: Color patches printed by using the CMYK sequence

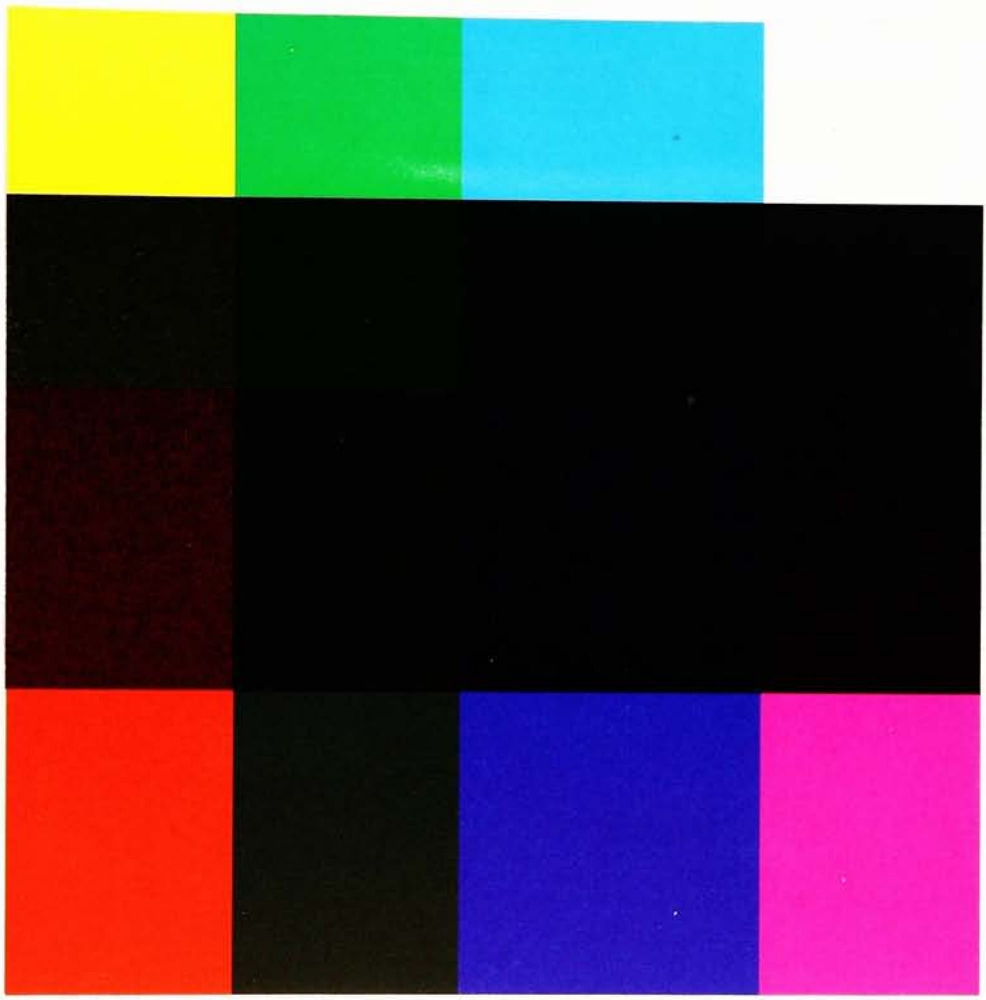


Figure 18 : A normal key picture printed by using the CMYK sequence

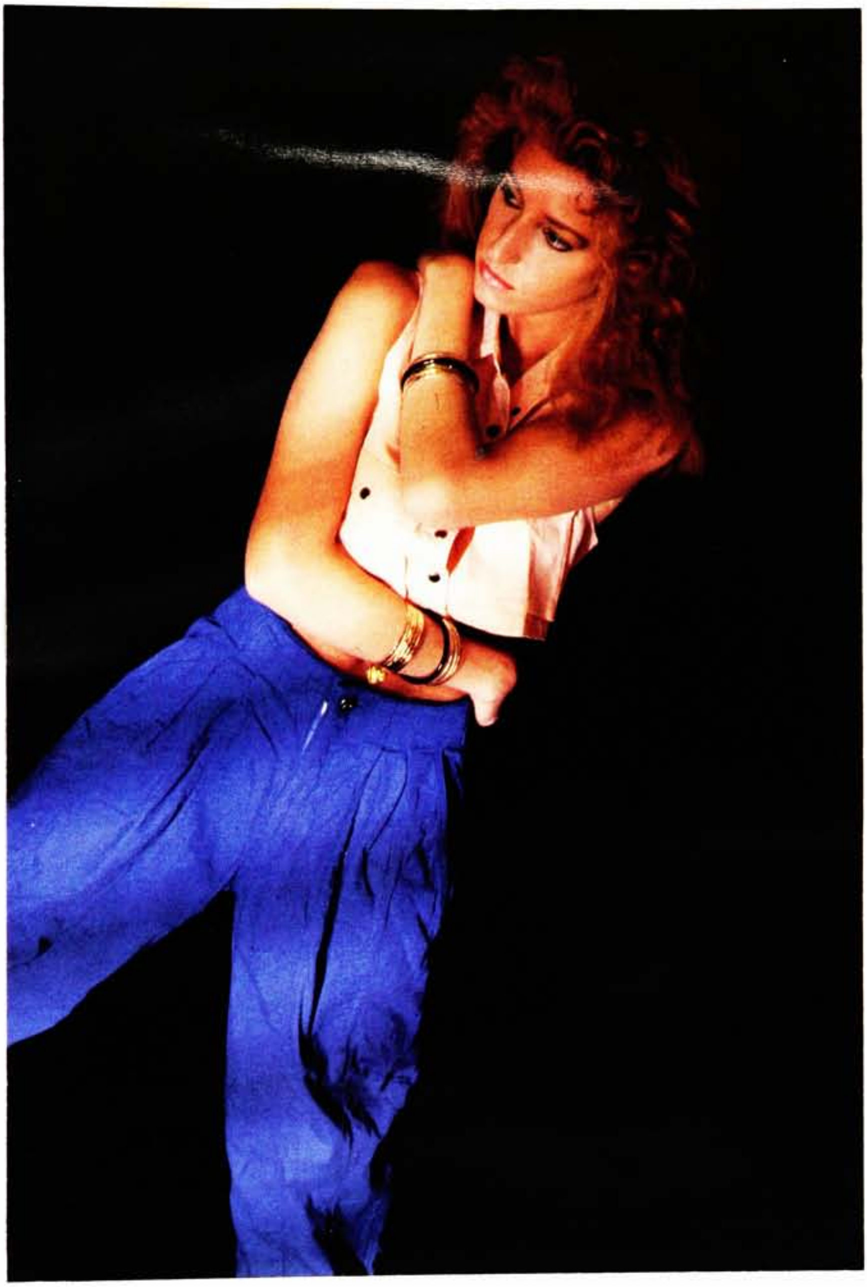


Figure 19: A high key picture printed by using the CMYK sequence

Figure 20: A low key picture printed by using the CMYK sequence

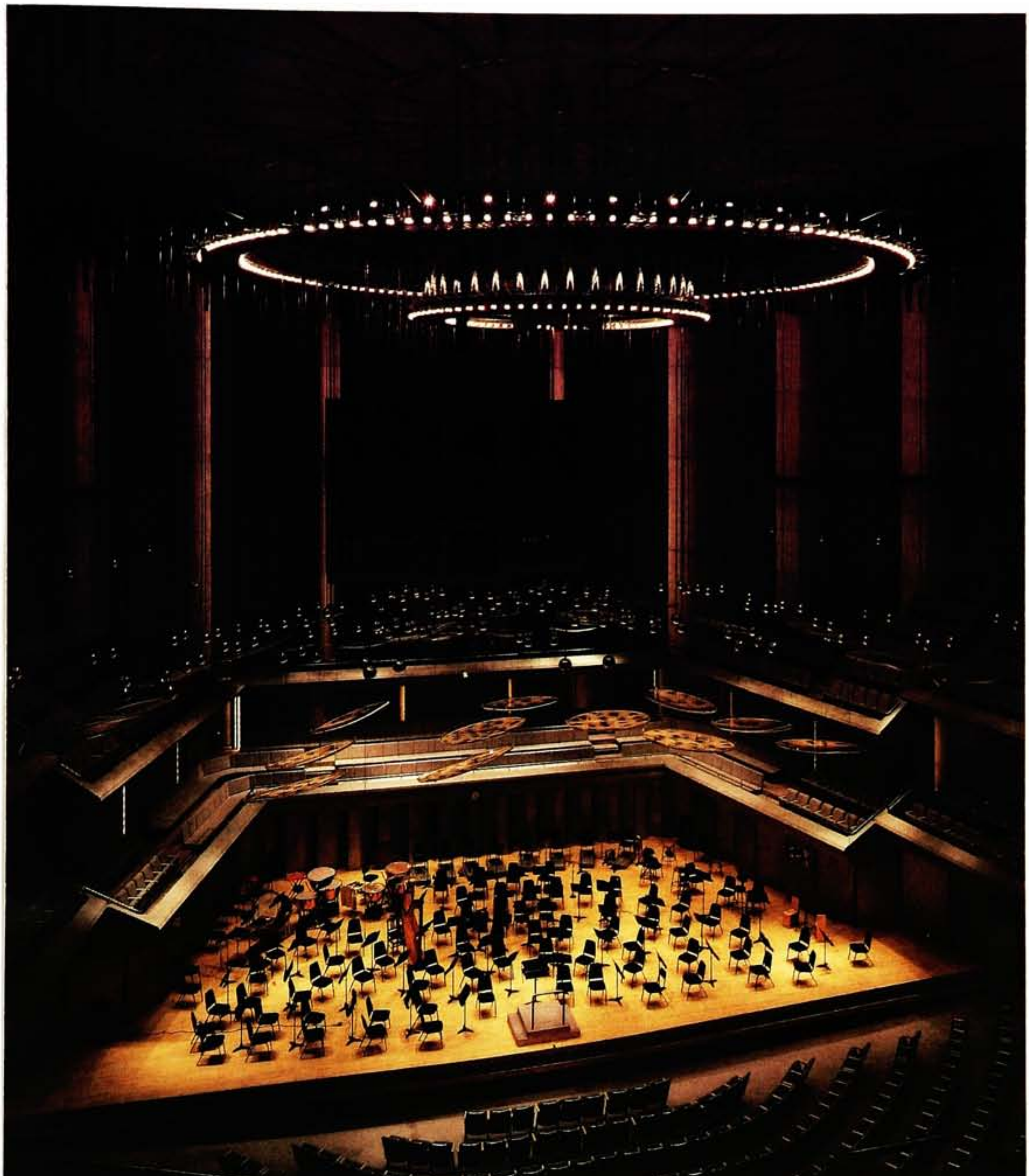


Figure 21: A skin tone picture printed by using the CMYK sequence

Figure 22: Color patches printed by using the KCMY sequence

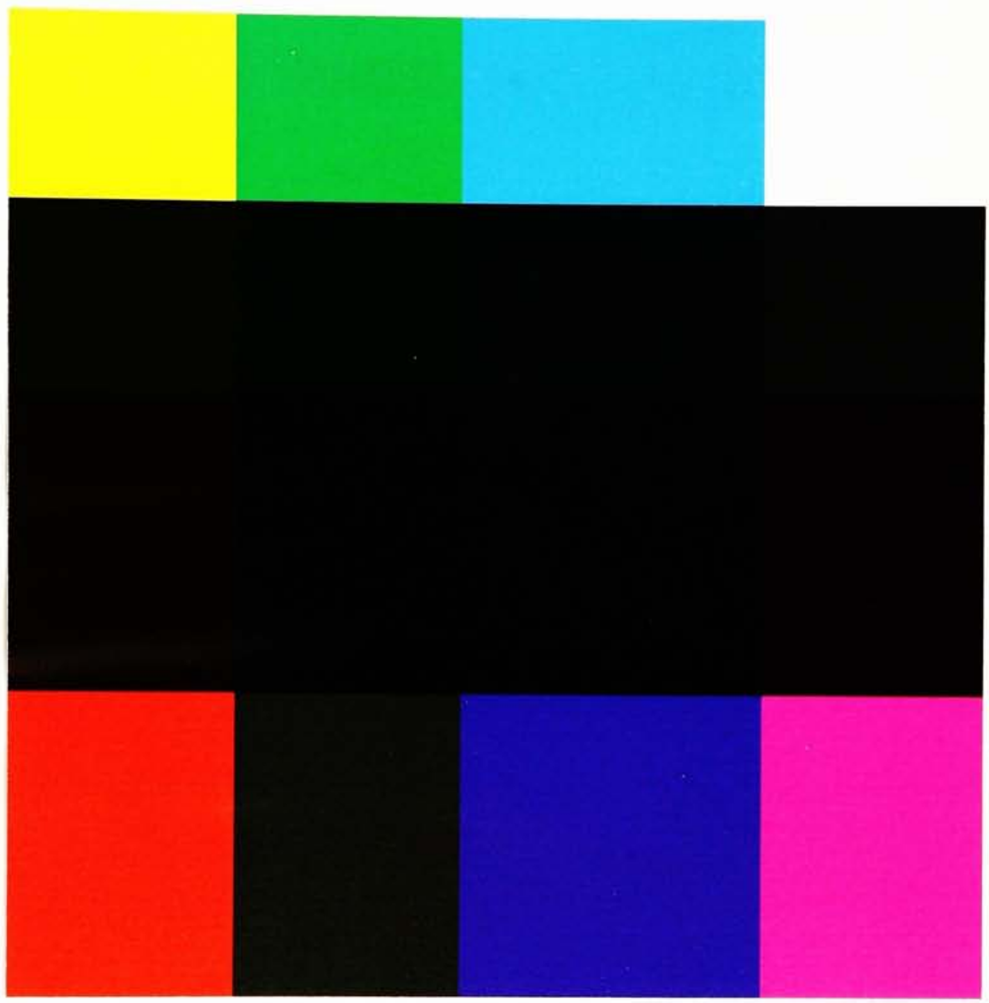


Figure 23 : A normal key picture printed by using the KCMY sequence

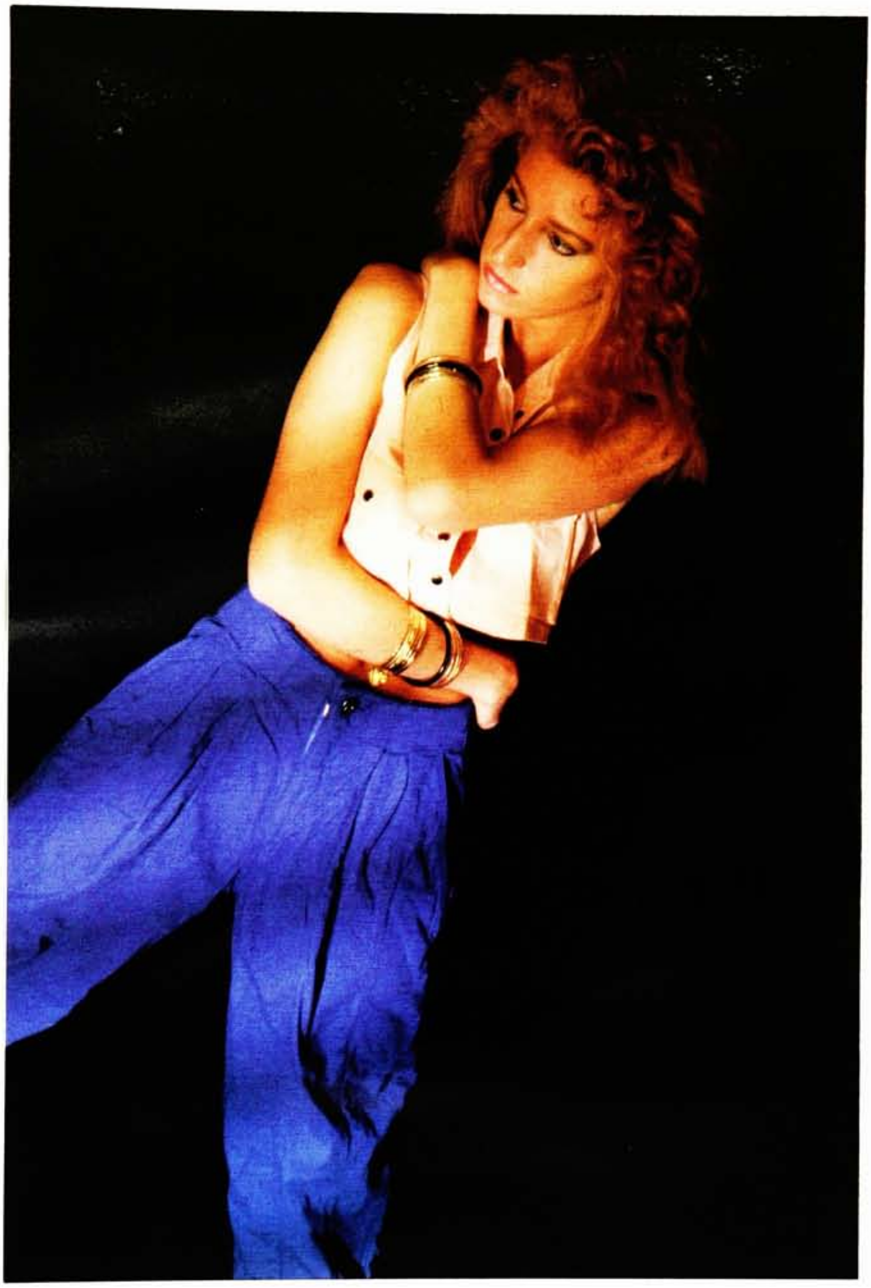


Figure 24: A high key picture printed by using the KCMY sequence

Figure 25: A low key picture printed by using the KCMY sequence

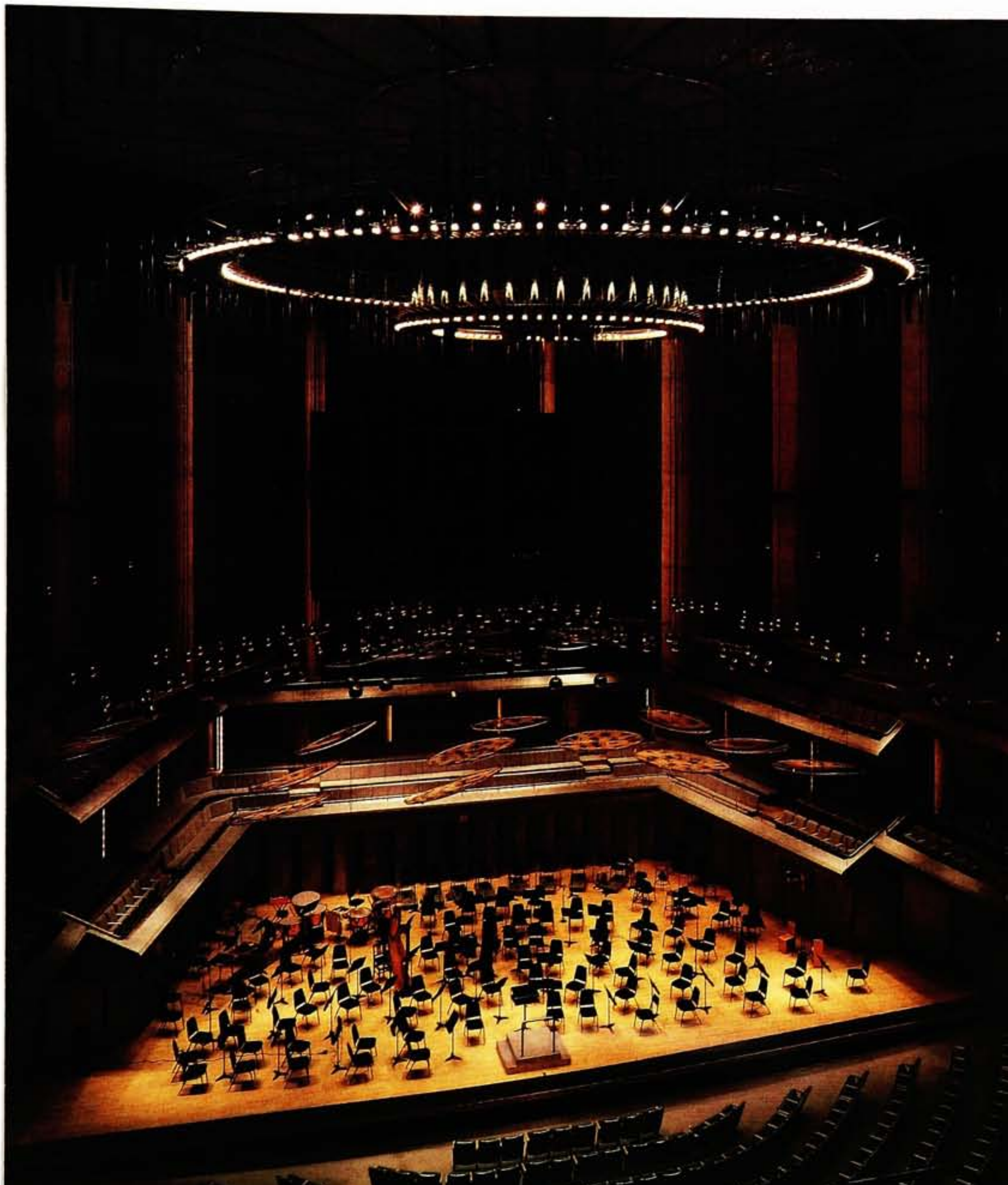


Figure 26: A skin tone picture printed by using the KCMY sequence

VITA

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She was the assistant head of the Printing Technology Section at the Electricity Generating Authority of Thailand, from 1981 to 1985. From 1985 to present, she has been a lecturer at the Department of Photographic Science and Printing Technology, Faculty of Science, Chulalongkorn University in Bangkok, and was on a sabbatical leave to study in the U.S. during 1986 to 1988.