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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
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**A COMPARISON OF PAPER WHITENESS RANKINGS:
VISUAL vs. INSTRUMENT GENERATED**

by

Lawrence David Harris

**A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
School of Printing Management and Sciences in the
College of Imaging Arts and Sciences of the
Rochester Institute of Technology**

May 1993

**Thesis Advisor: Mr. Chester J. Daniels
Co-Advisor: Professor Emeritus Joseph E. Brown**

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Visual vs. Instrument Generated**

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May 1993

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Abstract

The purpose of the study was to find if a correlation exists between a previously conducted visual whiteness ranking of 128 sheets of white office paper, from various manufacturers, and a ranking generated by affordable hand held colorimeters.

Two different hand held colorimeters were used to measure the 128 sheets. The output from the colorimeters was in CIE chromaticity coordinates and CIELAB L^* a^* b^* values. The lightness (L^*) value was used to make a ranking for comparison to the visual ranking. The chromaticity coordinates were used for computing CIE Whiteness. The resulting whiteness index values were used to form a ranking for comparison to the visual ranking.

The ranking comparisons were plotted, correlations determined, and regression analysis performed. The analysis demonstrated that a correlation does exist between the visual and instrument rankings. The scatter plots show that the relationship is most likely linear. The strongest correlations occurred with CIE Whiteness rankings generated from measurements using an X-Rite 948 hand held colorimeter set to Illuminant C or D_{65} . The strongest correlation had an r value of .953 with r^2 value of 90.8%.

Chapter 1

Introduction

Whiteness of paper is an important characteristic that is expected to have an effect on printed color. Inks used for printing are usually transparent and act as filters by absorbing light and control the color of the light reflected to the observer. The paper also absorbs and reflects light. Therefore, the light reflected by the paper surface back up through the ink layer(s) might be expected to change the final color observed.

Two issues that need to be addressed, are the definition of whiteness, and how it is measured. It should be clear that whiteness is not necessarily the same as brightness and lightness. A white surface is a surface that reflects light, most of the visible spectrum, diffusely in all directions.¹

One method of determining whiteness is by comparison to a white standard of Magnesium Oxide. Magnesium oxide does not absorb any light within the visible spectrum, it reflects all the wavelengths. It is possible to measure the spectral reflectance of the sample and compare the measurement to the reflectivity curve of Magnesium Oxide.² This will yield whiteness and shade information.

Another method to determine whiteness is by using the Commission International de l'Eclairage (CIE) color system. From the CIE system, many systems have been developed to describe a color and its components. Two examples of these systems include Hunter L, a, b, and the CIE 1976 L* a* b*. Both systems use lightness, red to green chroma, and yellow to blue chroma to describe a color.³ The Hunter system describes a point within a uniform color space. Measurement is accomplished using a colorimeter with a known light source and detector response.

Additional considerations are brightness standards, fluorescence, the geometry of the light source and sensing point in measuring instruments, and whether or not an integrating sphere is used.

Purpose of the Study

The purpose of the study was to find if a correlation exists between a previously conducted subjective ranking of 128 white sheets of paper and a CIE whiteness ranking to be generated by easily obtainable instrumentation. In addition, the L* values from the CIE L* a* b* were examined to ascertain if a relationship exists between the subjective ranking and L* value. If a correlation exists, instrumentation could be used to predict the samples location in the subjective ranking. The rankings are an indication as to the whiteness of the sheets and its effects when printed.

The instrumentation used was two hand held colorimeters. These instruments are affordable and in use at many printing facilities.

Endnotes for Chapter 1

1. Richard S. Hunter and Richard W. Harold, The Measurement of Appearance (New York: John Wiley and Sons, 1987), p. 195.
2. William H. Bureau, "Paper: Appearance Properties", Graphic Arts Monthly (vol. 59, no. 9, Sept. 1987), p. 140.
3. Hunter, p. 143.

Chapter 2

A Review of the Literature in the Field

The theoretical background for this study requires discussion of several topics. These topics include: light and color perception, whiteness perception, brightness, densitometry, illuminants, sources, CIE standard observer, colorimetry, color description, $L^* a^* b^*$, and whiteness indices.

Light and Color Perception

Light is a form of radiant energy which when it strikes the retina, the inner lining at the rear of the eye, causes a chemical change. The chemical change is electrically transmitted to the brain where it is interpreted as sight.¹

The retina is composed of layers with the innermost layer, the layer toward the center of the eye, being fairly transparent and consisting of nerve cells and interconnecting fibers. This layer gathers the information for transmission to the brain. The nerve cells end in the actual light receptors. The last layer is a black pigment which absorbs light.²

There are two types of receptors in the retina, rods and cones. The rods are sensitive

to a large range of light intensity and the cones are sensitive to both intensity and wavelength. The rods are highly concentrated in the perimeter of the retina and decrease in number toward the center of the retina. They detect low levels light and have low resolving power. The rods are not involved in color vision, but are used for night vision.³

The center area of the retina, the fovea, consists only of cones in the center two degrees of vision. This area has the highest resolving power. From the center area, the number of cones decreases toward the perimeter. The cones may have a wide range of spectral sensitivity, but they are grouped with three maximum sensitivities in separate parts of the visual spectrum.⁴ There are groups of cones sensitive to blue light, others sensitive to green light, and groups sensitive to red light. This three color sensitivity, or trichromatic vision, forms the basis for most methods of color measurement.⁵

The combination of light itself, the cones in the retina, and the visual neural network form the physiological part of color, the brain provides the psychological interpretation of color.⁶ There are other theories, and there is still much left to be studied and understood about the color sensation and physiology of the eye.

If all the visual wavelengths of light, 400 to 700 nanometers, are equal in intensity, then the perception of white light is produced in the observer.⁷

Whiteness Perception

Whiteness is generally thought of as clean or pure. White surfaces ideally reflect uniformly and scatter diffusely all wavelengths of light, and do not absorb any light. Standards of whiteness use reflectance values from samples of neutral whites including magnesium oxide and barium sulfate. Originally, these whites were assigned the highest whiteness index number of 100.⁸

The problem with whiteness perception is that when humans as individuals are involved, there are differences in preferences between different observers. Many observers tend to consider the whitest surface to be the one with an additional amount of blue light reflection.⁹ Some observers prefer a pink tint. In both cases, a yellow or green tint would be a penalty. As a result, many whiteness index equations favor bluish whites, some pinkish whites, rather than neutral whites.¹⁰

Brightness

Brightness is often used and confused when discussing the whiteness of paper. Most white objects have some impurities that absorb blue light. This tends to make the object appear to have a yellow cast. If the object can be made to reflect more blue light, then it appears to be brighter or more white.¹¹ Often agents are added to paper to increase the blue reflectance to achieve a greater perception of whiteness. Pulp, before it is formed into paper, is bleached to remove the impurities that absorb blue light. Hence, the paper will appear whiter. The bleaching process is monitored

by using a brightness tester.¹² The TAPPI test method T 452 om-87 brightness, is based on reflectance of blue light (457 nm) at a specified geometry, and a standard brightness scale.

The difference between whiteness and brightness lies within the measuring technique. Only one wavelength, 457 nanometers, of reflected blue light is measured for the brightness test. Whiteness is based on colorimetry, which is used to measure the reflectance of visible light, 400 through 700 nanometers, in 10 nanometer increments.

Densitometry

Densitometry is used to measure the amount of light a material absorbs. Specifically, reflection densitometry is the measurement of light reflected from a surface. The value representing the amount of reflected light is divided by the value for the amount of available light, referred to as incident light, to yield a normalized ratio called reflectance. Optical density is the reciprocal of reflectance. Therefore, as reflectance decreases, the density increases, or we view the sample as being darker. In order to relate density to our visual response, the reciprocal of reflectance is multiplied by \log_{10} . Mathematically stated, density is calculated:

$$\text{Density} = \log_{10} \frac{1}{R}$$

where R = reflectance

Optical density responds to changes in the thickness of an ink film on a sheet of paper. Thicker ink films normally have higher optical density.

Color filters may be used with the densitometer to make it more sensitive to specific areas of visible light. This sensitivity increase is used to measure ink film thickness of specific colors of ink. The densitometer "...does not measure color as we see it, and therefore does not measure color."¹³ While the densitometer does measure how much light is reflected by a sheet of paper, it can not accurately measure whiteness because it does not match our visual response, nor does it account for the light source used when measuring.

Illuminants

In order to create viewing conditions that are consistent, standardized conditions including lighting need to be stipulated. To reproduce consistent lighting, artificial sources are used. In 1931 the Commission International de l'Eclairage (CIE) defined three standardized Illuminants.

The illuminants have a specified spectral power distribution content. The first of these illuminants, Illuminant A, was defined to represent an incandescent light source. The second illuminant, Illuminant B, represents direct sunlight, and the third, Illuminant C, represents daylight.¹⁴ The Illuminants are an ideal stated spectral power distribution listed in five nanometer increments in the visible light range of

380 nanometers to 770 nanometers.

Sources

A light source is a physical device. If the spectral power distribution of the source, determined by measurement, matches that of an Illuminant, then the source is a standard source. Such is the case for an incandescent lamp with a tungsten filament. The spectral power distribution of the lamp matches closely with the defined distribution of Illuminant A. A tungsten filament lamp and filter form the standard source for Illuminant B. The standard source for Illuminant C is also a lamp and filter combination.

While it is possible to measure the spectral power distribution of a light source, it is not always possible to have a light source to represent an Illuminant. A light source with a power distribution matching Illuminant D does not yet exist.¹⁵ Illuminant D has been defined as a series of illuminants to more closely represent daylight and to include additional spectral energy in the ultraviolet region. The ultraviolet energy is useful for evaluating fluorescing materials where nonvisible light is reflected back to the viewer as visible light.¹⁶ Various sources have been manipulated with filters and auxiliary sources to approximate the D series.

Standard Observer

The 1931 the Commission International de l'Eclairage (CIE) also defined a Standard Observer which is a representation of the average visual response of people with normal color vision.¹⁷ The standard observer was determined experimentally by having observers match colors projected on a screen inside a box. The field of vision into the box was controlled with an aperture set to two degrees. The observer would adjust each of the intensities of three lights, red, green, and blue, so that color of the top half of the screen would match the bottom half. The intensity settings for the lamps were recorded and another wavelength of light would be tested.¹⁸ This observer is referred to as the CIE 1931 2 degrees Standard Observer. In 1964, the CIE recommended another observer for large samples where a greater angle of vision is used. The 1964 CIE 10 degrees Standard Observer is often referred to as a supplementary observer.

The values listed for the Standard Observer are called tristimulus values and are used to describe a color in terms of the visual response to the three primary lights of red, green, and blue.¹⁹ These values can be used with a spectral curve reflected by an object to yield a set of values called CIE tristimulus values.

The CIE Standard Observer and Illuminants when used in conjunction with the spectral curve of light reflected by of an object, form the basis for Colorimetry.

Colorimetry

The physical measurements of color can be made using a spectrophotometer. The instrument can be used to measure the spectral reflectance of each wavelength of visible light. Generally, increments of ten nanometers are used to measure the spectral reflectance curve for an object. When the curve is used in calculations with a CIE Illuminant and Standard Observer, the CIE tristimulus values for the reflectance of the object may be calculated.

The CIE Tristimulus Values are calculated by multiplying the value for the spectral power distribution P of an illuminant at a given wavelength with the value for the spectral reflectance R of the object at the same wavelength. The process is repeated wavelength by wavelength such that the two spectral curves yield the product curve PR . The curve PR is multiplied, again wavelength by wavelength, with each of the three tristimulus values, \bar{x} , \bar{y} , and \bar{z} , for the spectrum colors of the standard observer to yield three product curves $PR\bar{x}$, $PR\bar{y}$, and $PR\bar{z}$. The product values for each of the curves are then added together to yield CIE Tristimulus Values X , Y , and Z .²⁰

Mathematically stated, the CIE Tristimulus Values are calculated:

$$X = k \sum PR\bar{x} \qquad Y = k \sum PR\bar{y} \qquad Z = k \sum PR\bar{z}$$

$$\text{where } k = \frac{100}{\sum P\bar{y}}$$

It should be noted that k is used to normalize the equations such that $\sum \overline{P}R\overline{y}$ summation is equal to 1.0 for the perfect reflecting white. The Y value is often referred to as the luminance factor and is thought to be related to the perceived lightness of the object. For the perfect white sample, Y was assigned a value of 100.²¹

By using the values for CIE illuminants and observers, the spectral information for the light source in the spectrophotometer need not be considered.²²

A colorimeter uses a standard light source and a set of filters so the detector will closely mimic the Standard Observer. The output will be CIE tristimulus values for reflectance of the object being measured. The colorimeter output represents the human visual response since the source and detector are coordinated to the CIE Illuminant and Observer. Colorimeters often display color readings in additional output forms such as opponent color scales like Hunter ($L^* a^* b^*$) and CIELAB ($L^* a^* b^*$).²³

Color Description

Color is often described using three variables derived from the Munsell System. The first of these is hue. Hue is the description of the color in terms of its base color such as red, blue, green, or yellow. The second variable is value. Value is used to describe the lightness of the color in reference to gray from a range black to white. The final variable is chroma. Chroma is the description of how much of the

hue of the color is present referenced from a gray to full saturation of the hue.²⁴

The CIE tristimulus values numerically describe a color in terms of its hue and chroma, known as chromaticity, and its lightness or luminance. The CIE tristimulus values can be used to calculate chromaticity coordinates which can be plotted on a chromaticity diagram.

The main purpose of the chromaticity coordinates is to determine if two colors, actually color stimuli or lights, are a match. The system is not used for identifying color, nor is it used with the object alone, but in combination of light, object and observer.²⁵ By knowing where the coordinates lie on the diagram, the hue of the color may be approximated. The problem with this system is that it is two dimensional, lightness is not displayed, and it is not related to the visual response in terms of equal steps of perception. The coordinates are calculated by the following:

$$x = \frac{X}{X + Y + Z} \quad y = \frac{Y}{X + Y + Z} \quad z = \frac{Z}{X + Y + Z}$$

Usually only x and y are used for plotting on the diagram.²⁶

L* A* B*

Various attempts have made to mathematically manipulate the CIE Chromaticity Coordinates to better describe color and match a color measuring system

to equal visual intervals, or a uniform color scale. Several of the transformations have been the basis of opponent color spaces.

Opponent color spaces are based on the theory of the eye containing receptors, cones, for three colors of light; red, green, and blue. In addition, the information from the receptors is processed into three signals. The first signal is light or dark, or white to black. The other two signals are red verses green and yellow verses blue. The letter "L" is used to represent the coordinate for lightness. White is assigned a value of 100, black is assigned 0. The letter "a" is used to represent the coordinate red verses green. A color cannot be red and green at the same time, so a positive value is used for red, while negative values are used for green. The letter "b" is used to represent yellow verses blue, with positive values for yellow and negative for blue.²⁷ When plotted on the cartesian coordinate system, "a" is the x axis, "b" is the y axis, and "L" is the z axis.

The opponent system was developed by Hunter in 1942 for use in a tristimulus colorimeter he was developing.²⁸ The L a b system uses the equations:²⁹

$$L = 10.0 (Y)^{1/2}$$

$$a = [17.5 (1.02 X - Y)] / (Y)^{1/2}$$

$$b = [7.0 (Y - 0.847 Z)] / (Y)^{1/2}$$

Work continued on opponent systems and changes were made by others including

Scofield (1943), Nickerson (1950), Glasser and Troy (1952), and MacAdam (1974).³⁰

MacAdam proposed an opponent system based on a color space developed by Adams (1943), and modified by Nickerson (1950), to CIE in 1973. The proposal resulted in the CIE 1976 L* a* b* space known as CIELAB.³¹

CIELAB is a color space that is approximately uniform, or has perceived equal steps, and is plotted based on the following equations:³²

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

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

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

The X_n , Y_n , and Z_n , are used to normalize X, Y, Z, to a reference white with a value of 100.³³

TAPPI recommends using L a b or L* a* b* with Illuminant C and the 1931 Standard Observer for measuring whiteness in the Tappi Official Test Method T 524 om-86.³⁴

Whiteness Indices

White is a color which can be measured and described in an opponent color space. A sample can be measured and compared to a neutral white standard such as Magnesium Oxide. Whiteness is used to describe the color of an object as compared

to a preferred white. The preferred white, the white chosen by most observers, will often have a blue tint at the expense of decreasing reflectance.

Neutral white standards were assigned the highest value of 100 in a whiteness index. If any tint was present the index would be less than 100, but subjective evaluations rate bluish whites higher than neutral whites. Newer whiteness equations favor bluish whites and whiteness index (WI) values can be greater than 100.³⁵ There are additional equations used with green or pink tint preferences.

Whiteness index equations with greater weighting for the blue component (b) of the L a b system as compared to the lightness component (L) include the following:

Hunter Whiteness³⁶ $WI = L - 3b$

Stensby Whiteness³⁷ $WI = L - 3b + 3a$

The CIE adopted the following whiteness index in 1986 to be used with CIE Illuminant D₆₅:

CIE Whiteness³⁸ $W = Y + 800(x_n - x) + 1700(y_n - y)$

where x_n & y_n are the CIE chromaticity coordinates of the perfect diffuser.

The CIE equation penalizes both green and pink tints.³⁹

Literature Basis for the Study

A report prepared for the Tappi Optical Properties Committee, later published by B. D. Jordan and M. A. O'Neill as an article, forms the basis for this study. In the article entitled "The whiteness of paper colorimetry and visual ranking"⁴⁰, the authors attempt to match a set of instrument generated whiteness readings to a subjective visual ranking of 128 sample sheets of white office paper.

The authors start the article with a brief discussion of illuminants and sources. In the discussion, illuminants are described as "... a tabulated function of wavelength, used in colorimetric calculations, which describes the energy distribution in an idealized light source."⁴¹ The sources used to represent the illuminants are listed. It is stated an illuminant does not exist that represents indoor office lighting. This is important since the paper used in the ranking for this article is paper used and viewed in a indoor office setting.

The authors continue the article with the procedure used to establish the ranking of the sheets. After the subjective ranking was determined, instrument measurements were made using five different models of laboratory grade colorimeters. Four of the colorimeters have integrating spheres, and different light sources with filters were used. While one of the instruments did not have an integrating sphere, it was observed that the difference of geometry in the instruments did not affect the ranking generated by the instruments.

The conclusions of the article note consistent results were obtained in the visual ranking of the sheets. The instrument ranking which best matched the visual ranking was made with an instrument using a quartz halogen lamp as a source.

For this study, two hand held colorimeters, one with a pulsed xenon lamp and the other with a gas filled tungsten lamp, were selected. Both colorimeters have Illuminant C and Illuminant D₆₅ settings, and both can display CIELAB L* a* b* and chromaticity coordinates. The chromaticity coordinates are used to calculate CIE Whiteness. The values for L* and CIE Whiteness are used for comparison to the visual ranking.

Endnotes for Chapter 2

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41. Jordan and O'Neill, p. 93.

Chapter 3

The Hypotheses

The purpose of the study was to find if a correlation exists between a previously conducted subjective ranking of 128 white sheets of paper and a ranking to be generated by easily obtainable instrumentation. This could be useful for predicting the effect the paper has on printed color. The L^* (CIE LAB) and computed CIE WI (Whiteness Index) will be examined to ascertain if a relationship exists between the subjective ranking and the measured values.

Hypotheses

- 1.0 There is a relationship between a subjective ranking and an instrument generated CIELAB L^* response that is ranked for a group of 128 sheets of white paper.
- 2.0 There is a relationship between a subjective ranking and an instrument generated CIE whiteness response that is ranked for a group of 128 sheets of white paper.

Limitations

The hand held colorimeters do not have provisions for filter adjustments in order to control the amount of ultraviolet light present in the source illumination. Jordan and O'Neill found varying the amount of ultraviolet light in colorimeters with xenon sources affected the agreement between the visual ranking and instrument generated ranking.¹ The Minolta CR-200b uses a xenon lamp for its light source.

The samples may have changed color due to the amount of time that elapsed during the study. The samples were stored in a light tight box in an office for the two years that elapsed.

The composition of the sheets was not known or controlled for the study.

Delimitations

The scope of the study was to make an instrument generated ranking, using hand held colorimeters, for a given set of 128 sample sheets of white office paper to compare against a previously made subjective ranking.

It was not within the scope of this study to consider illuminants other than C or D₆₅.

There is an additional Illuminant F series that may be useful to consider.

The composition of the sheets was not considered in this study. The amount of

bleaching the pulp receives, or the quantity of fluorescent whitening agents added will most likely have a significant effect on the whiteness of the sheets.

Endnotes for Chapter 3

1. B. D. Jordan and M. A. O'Neill, "The whiteness of paper -- colorimetry and visual ranking.", Tappi Journal (May 1991), p. 99.

Chapter 4

Methodology

The purpose of the study was to find if a relationship exists between a previously conducted subjective ranking and a instrument generated ranking of 128 sheets of white office paper.

Subjective Ranking

The subjective, or visual, ranking was conducted by 11 members of the TAPPI Optical Properties Committee in normal office lighting environments. The method used to rank the sheets is referred to as the Rangefinder technique.¹ This technique is designed so that a large number of samples can be easily sorted by several judges fairly quickly with minimal fatigue. Each judge can move a sample only one category. The process was repeated in different offices, some offices with windows, some without windows.

In the "Report of Fluorescence Subcommittee to the Tappi Optical Properties Committee regarding average office lighting"² authors B. Jordan and M. O'Neill articulate the ranking procedure as follows:

The first judge chooses sequential pairs from a randomized stack and places the better member of each

pair in the stack on the right. A second judge then repeats the procedure to split each of these two stacks into two more. This results in four stacks of 32 sheets each. Those in the first stack have lost both comparisons, those in the second and third stacks have each won only one comparison, and those in the fourth stack have won both comparisons. Since the only difference between the second and third stacks is the order in which they won or lost their first two comparisons, these two stacks are combined. A third judge then repeats the judging with these three stacks and produces six stacks. Again, the intermediate stacks are merged. The entire cycle of splitting and merging stacks is continued until the best and worst categories each contain a single specimen.

In addition, each sheet was folded twice so that any viewing background interference would be excluded.

The ranking produces a bell-shaped distribution of the categories into which the paper samples were sorted. The categories are based on the number of competitions where each sheet was selected as being whiter.

Instrument Ranking

The instrument ranking was generated by using two commercially available hand held colorimeters. The instruments were calibrated following manufacturers' instructions and standards.

Instrument Specifications

Hand held Colorimeter:

Minolta Chroma Meter CR-200b
 serial # 15241006
 RIT # 181282
 source: pulsed xenon to simulate Illuminant C or D₆₅
 detector response: CIE 1931 2° Standard Observer
 measuring spot diameter: 8mm
 output: Y x y (CIE 1931) and L* a* b* (CIE 1976)
 geometry: diffuse illumination, 0° viewing angle
 reflection std: serial # 15231093
 reflection std date: none

Hand held colorimeter:

X-Rite 948
 serial # 000209
 source: gas filled tungsten-2856° K corrected for Illuminant C and D₆₅
 detector response: CIE 1931 2° Standard Observer
 measuring spot diameter: 8mm
 output: Y x y (CIE 1931), L* a* b* (CIE 1976)
 measuring range: 400nm 700nm in 20nm increments
 geometry: 0° Illumination angle, 45° viewing angle
 reflection std: p/n 968-62, serial # C4428406P-01269
 reflection std date: 12-09-91

Measuring Procedure

Each sample sheet was folded twice to form a tri-fold, and the resulting tri-fold was again folded twice forming another tri-fold so that nine layers of paper were between the viewing port of the instrument and the work surface. Measurements were made in four different areas on each sheet with the Minolta colorimeter set for Illuminant C. The values for CIE Chromaticity (Y, x, y) and CIELAB (L* a* b*) were recorded. Another set of measurements were made with the colorimeter set

for Illuminant D₆₅. The four sets of values for each illuminant, were averaged to yield one set of values. The procedure was repeated for the X-Rite colorimeter. The recorded measurements were entered into a Lotus® 1-2-3 release 2.01 spreadsheet for organization and analysis.

The values for L* were compared to the subjective ranking for each colorimeter for each illuminant. The intent of the comparison was to establish if a correlation exists between the subjective ranking and a ranking of L* values.

The values for the CIE chromaticity coordinates Y, x, and y were used to compute CIE Whiteness using the following equation:³

$$W = Y + 800(x_n - x) + 1700(y_n - y)$$

where $x_n=0.3127$ and $y_n=0.3290$ for the perfect reflecting diffuser with Illuminant D₆₅ and 2° Observer

where $x_n=0.3101$ and $y_n=0.3163$ for the perfect reflecting diffuser with Illuminant C and 2° Observer⁴

The resulting whiteness values for each colorimeter with each illuminant were compared to the subjective ranking to establish if a correlation exists.

The Hypothesis was tested using a simple regression and correlation analysis.⁵ The analysis was used to establish if a relationship exists and how strong of a relationship exists. The analysis was also used to determine whether or not the relationship is linear.

Endnotes for Chapter 4

1. B. D. Jordan and M. A. O'Neill, "The whiteness of paper -- colorimetry and visual ranking.", Tappi Journal (May 1991), p. 94.
2. B. Jordan and M. O'Neill, "Report of Fluorescence Subcommittee to the Tappi Optical Properties Committee regarding average office lighting", Personal copy of paper received from Frank Foley and Cheryl Warner, Eastman Kodak, pp. 3-4.
3. Richard S. Hunter and Richard W. Harold, The Measurement of Appearance, (New York: John Wiley and Sons, 1987), p. 207.
4. Gy Lukacs, "Whiteness the Feasible Method for Evaluation", Hungarian Scientific Instruments (1985/60), p. 59.
5. Edward N. Dubois, Essential Statistical Methods for Business, (New York: McGraw-Hill Book Company, 1979), pp. 225-235.

Chapter 5

The Results

The numerical data generated from the measurements is listed in Appendices A – H. The resulting L* values and CIE Whiteness Index values are listed in both Visual Rank order, in Appendices I and J, and Grade Code order (sample sheet number) in Appendices K and L.

Data Analysis

The results were organized into eight comparisons. These are as follows:

Minolta CR-200b with Illuminant C displaying L* vs. Visual Ranking

Minolta with Illum. C and calc. WI from Y, x, y vs. Visual Ranking

Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking

Minolta with Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

X-Rite 948 with Illuminant C displaying L* vs. Visual Ranking

X-Rite 948 w\Illum. C and calc. WI from Y, x, y vs. Visual Ranking

X-Rite 948 w\Illuminant D₆₅ displaying L* vs. Visual Ranking

X-Rite 948 w\Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

For each of the comparisons a correlation was determined, regression analysis performed, and a scatter plot generated using Minitab[®] release 8.21.

Pearson's product-moment correlation was used find the degree or strength of the relationship between the visual ranking and instrument generated rankings.

Correlation values range from -1.0 to +1.0. The strongest correlations are those with values of -1.0 or +1.0, while correlation with a 0.0 value indicates no relationship is present between two sets of variables. A positive value indicates that as the value of one of the variables increases, the value of the response variable also increases. A negative value shows that as the value of the first variable increases, the value of the response will decrease. A general interpretation of correlation¹ is listed as:

- .80 to 1.00 strong relationship
- .60 to .79 moderate relationship
- .40 to .59 good relationship
- .20 to .39 weak relationship
- .00 to .19 chance relationship

A *t* test was performed on the ranking pair with the weakest correlation. The Minolta with Illuminant C displaying L* vs. Visual Ranking and the Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking both had identical values of .542 for *r*, the correlation coefficient. A *t* test for a correlation coefficient² is used to determine if a correlation is significant or a chance relationship. In this test a confidence level of .05 was used with degrees of freedom (d.f.) equal to 126. The calculated value for *t* was 7.241 which was then compared the value in a *t* table. The critical value listed in the table for an α equal to 0.05 and 126 d.f. is 1.960. Since $t=7.241$ is greater than

1.960, the null hypothesis (there is not a relationship between the rankings) is rejected. Restated, there is a relationship. Since the t test performed on the lowest correlation was significant, there was no need to perform this test on larger coefficients.

Scatter plots were generated for the eight pairings. Scatter plots are used to show graphically what kind of relationship may exist between two sets of variables. If a relationship exists, it may be linear or curvilinear. All eight diagrams show that a relationship exists and is most likely linear.

Regression analysis was performed to determine the equation of the straight line that best fits the scatter plot data for each pair of rankings. The regression equation is useful for predicting output response values for given input or predicting values. The equation is used for points within the extreme ends of the line. The scatter plots were again generated, but with the best fit line added for clarity. The regression equation used in conjunction with the correlation coefficient, determines the nature of the relationship and the strength of the relationship.

Results of the Eight Comparisons

Minolta CR-200b with Illuminant C displaying L* vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 1. The correlation for the relationship is .542 and 29.4% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = 32.1 + 0.383 \text{ Min-C-L}^*$.

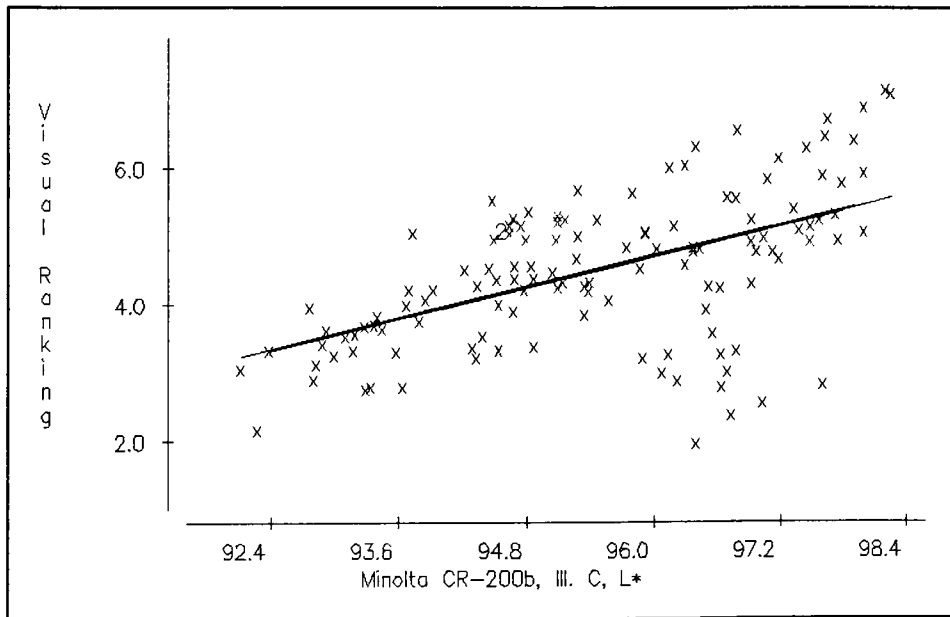


Figure 1. Minolta CR-200b with Illum. C displaying L* vs. Visual Ranking

Minolta with Illum. C and calculated CIE WI from Y, x, y vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 2. The correlation for the relationship is .804 and 64.6% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = -6.44 + 0.133 \text{ Min-C-WI}$. The data in Figure 2 is more concentrated around the best fit line supporting the higher r^2 value as compared to Figure 1.

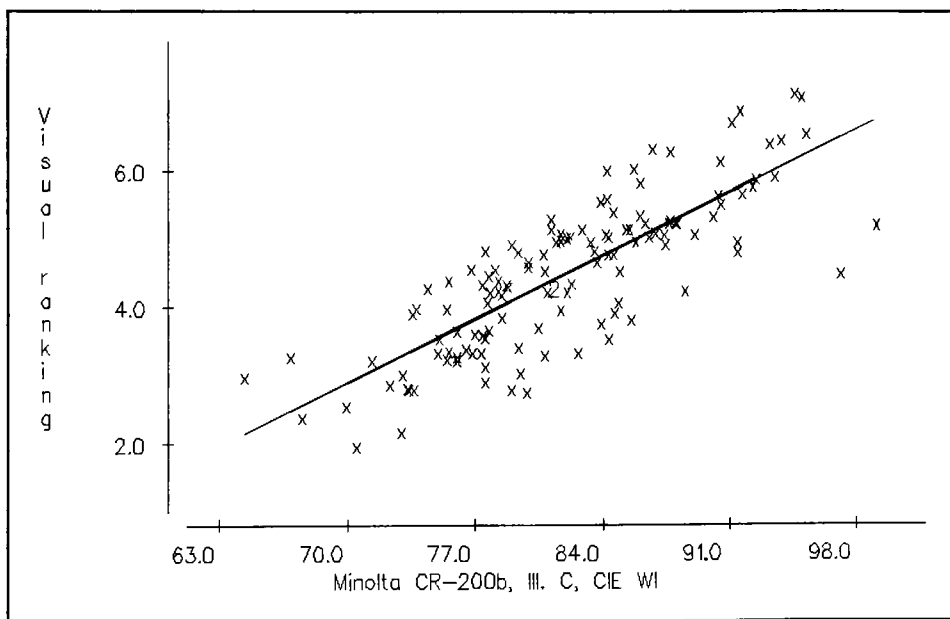


Figure 2. Minolta with Illum. C and calc. CIE WI from Y, x, y vs. Visual Ranking

Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 3. The correlation for the relationship is .542 and 29.4% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = 32.0 + 0.383 \text{ Min-D-L}^*$. The scatter plot in Figure 3 is very similar to Figure 1. The only variable changed between the data sets for Figures 1 and 3 was the illuminant selected on the instrument.

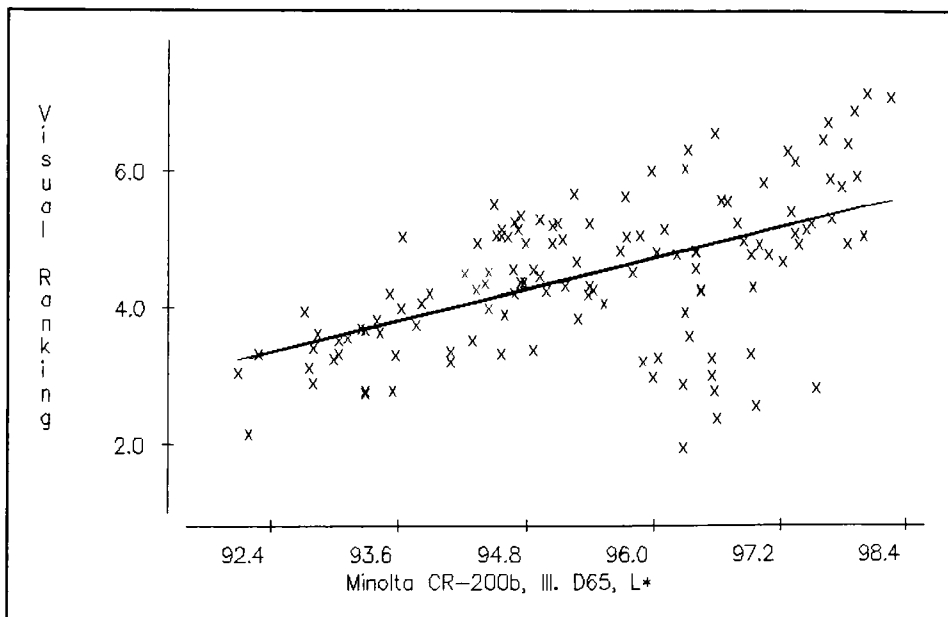


Figure 3. Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking

Minolta with Illum. D₆₅ and calculated CIE WI from Y, x, y vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 4. The correlation for the relationship is .805 and 64.7% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = -6.58 + 0.136 \text{ Min-D-WI}$. The scatter plot in Figure 4 is very similar to Figure 2. The only variable changed between the data sets for Figures 2 and 4, was the illuminant selected on the instrument.

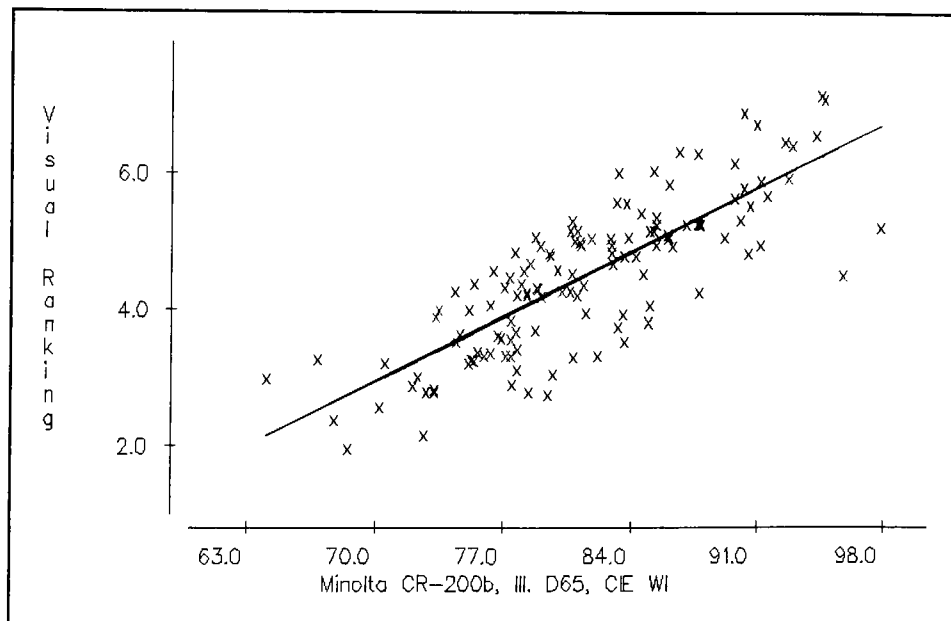


Figure 4. Minolta with Illum. D₆₅ and calc. CIE WI from Y, x, y vs. Visual Ranking

X-Rite 948 with Illuminant C displaying L* vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 5. The correlation for the relationship is .568 and 32.3% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = -34.3 + 0.406 \text{ Xrt-C-L}^*$. The scatter plot in Figure 5 is very similar to Figure 1. The variable changed between the data sets for Figures 1 and 5 was the instrument used to measure the samples.

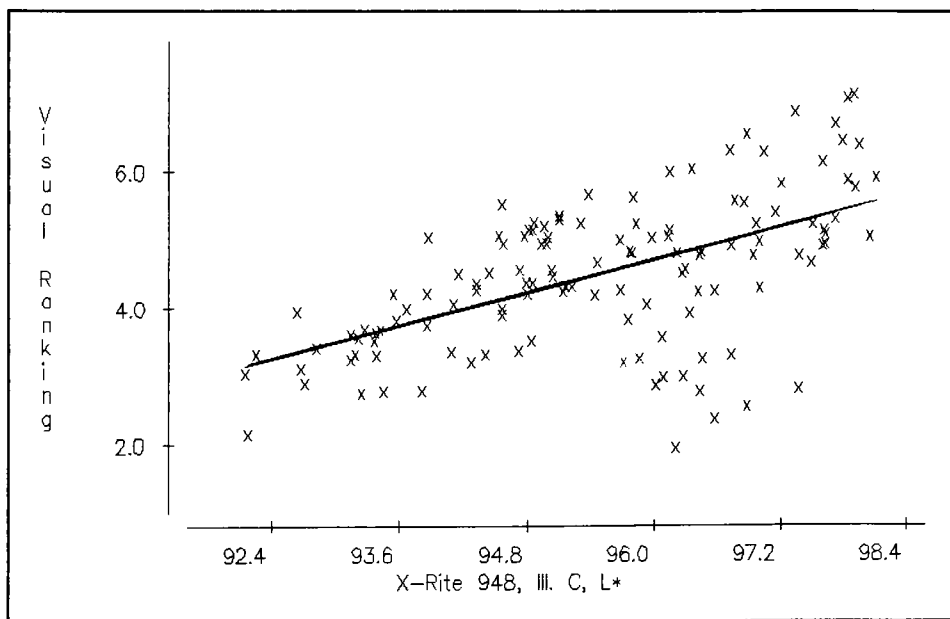


Figure 5. X-Rite 948 with Illuminant C displaying L* vs. Visual Ranking

X-Rite 948 w\Illum. C and calc. WI from Y, x, y vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 6. The correlation for the relationship is .953 and 90.8% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = -3.43 + 0.0943 \text{ Xrt-C-WI}$. The data in Figure 6 is more concentrated around the best fit line supporting the higher r^2 value as compared to Figure 5. The variable changed between figures 5 and 6 was the color space selected. In comparing Figures 2 and 6, the data in Figure 6 is closer to the best fit line. The difference between Figures 2 and 6 was the instrument selected.

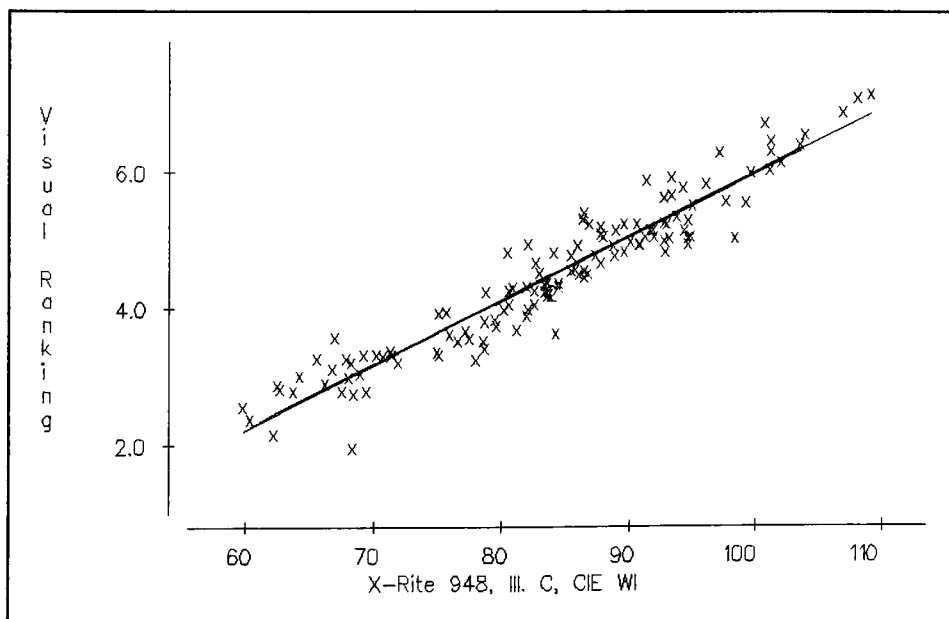


Figure 6. X-Rite 948 w\Illum. C and calc. WI from Y, x, y vs. Visual Ranking

X-Rite 948 w\Illuminant D₆₅ displaying L* vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 7. The correlation for the relationship is .574 and 33.0% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = 35.0 + 0.414 \text{ Xrt-D-L}^*$. The scatter plot in Figure 7 is very similar to Figure 5. The variable changed between the data sets for Figures 5 and 7 was the illuminant selected on the instrument. In comparing Figures 3 and 7, the data fit in both figures is similar. The difference between Figures 3 and 7 was the instrument selected.

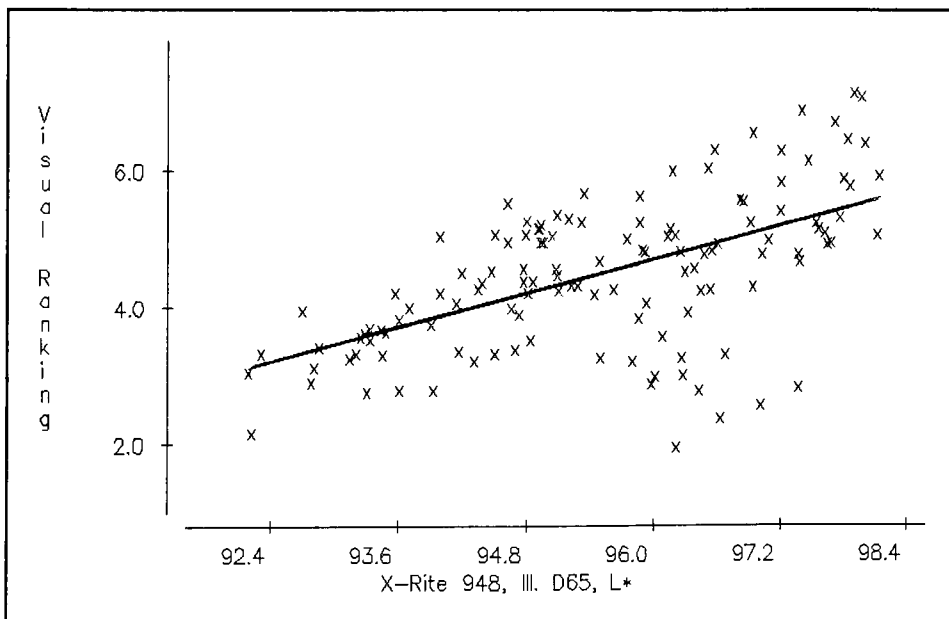


Figure 7. X-Rite 948 w\Illuminant D₆₅ displaying L* vs. Visual Ranking

X-Rite 948 w\Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

The scatter plot for the comparison indicated a linear relationship exists between the two rankings. This is supported with the addition of the best fit regression equation line added to the scatter plot as shown in Figure 8. The correlation for the relationship is .953 and 90.9% (r^2) of the data points for the ranking fall on the best fit line. The regression equation determined for the ranking was $\text{Visual} = -3.72 + 0.0979 \text{ Xrt-D-WI}$. The data in Figure 8 is more concentrated around the best fit line supporting the higher r^2 value as compared to Figure 7. The variable changed between figures 7 and 8 was the color space selected. In comparing Figures 8 and 4, the data in Figure 8 is closer to the best fit line. The difference between Figures 4 and 8 was the instrument selected.

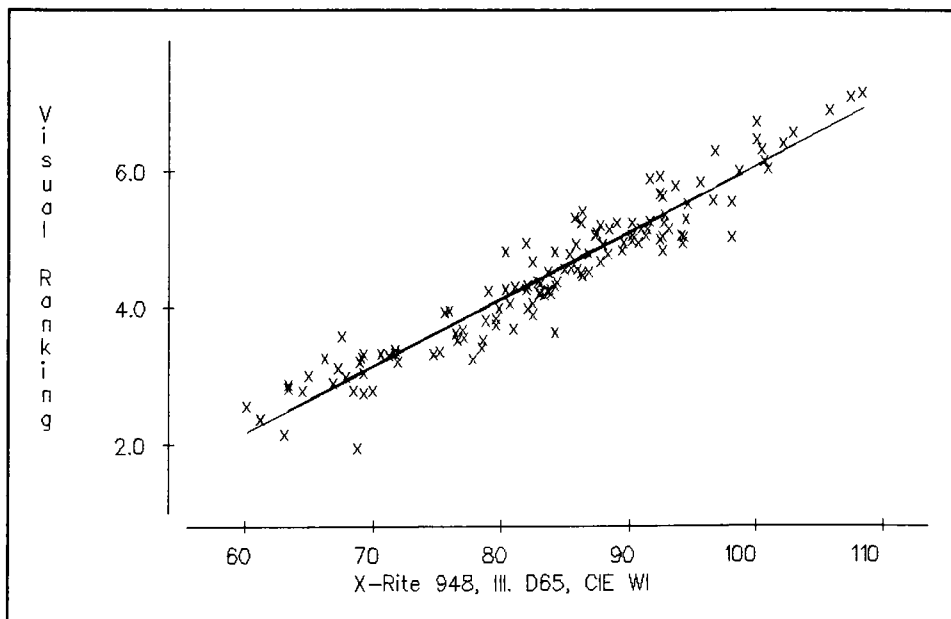


Figure 8. X-Rite 948 w\Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

Summary of Findings

A summary of findings in order of strongest to weakest correlation coefficient (r) is presented in the chart below (in all equations, the response variable (y) is the value from the visual ranking):

-(r)-	Strength	Equation for best fit line	Reference	Predictor variable (x)
.953	strong	$y = -3.72 + 0.0979 x$	Fig. 8	X-Rite D ₆₅ , CIE WI
.953	strong	$y = -3.43 + 0.0943 x$	Fig. 6	X-Rite C, CIE WI
.805	moderate	$y = -6.58 + 0.136 x$	Fig. 4	Minolta D ₆₅ , CIE WI
.804	moderate	$y = -6.44 + 0.133 x$	Fig. 2	Minolta C, CIE WI
.574	good	$y = -35.0 + 0.414 x$	Fig. 7	X-Rite D ₆₅ , L*
.568	good	$y = -34.3 + 0.406 x$	Fig. 5	X-Rite C, L*
.542	good	$y = -32.1 + 0.383 x$	Fig. 1	Minolta C, L*
.542	good	$y = -32.0 + 0.383 x$	Fig. 3	Minolta D ₆₅ , L*

The correlation coefficients and equations are on the same page as the reference figure. The strength of the relationship description is from the text on page 32 of this chapter.

Endnotes for Chapter 5

1. Robert H. Koenker, Simplified Statistics - For Students in Education and Psychology, (Totowa, New Jersey: Littlefield, Adams & Co., 1971), p. 52.
2. Koenker, p. 60.

Chapter 6

Summary and Conclusions

The purpose of the study was to find if a relationship exists between a previously conducted subjective ranking of 128 white sheets of paper and a ranking to be generated by easily obtainable instrumentation. The L^* from CIELAB and computed CIE WI (Whiteness Index) were examined to ascertain if a relationship exists between the subjective ranking and the measured values.

Hypotheses Review

1.0 There is a relationship between a subjective ranking and an instrument generated CIELAB L^* response that is ranked for a group of 128 sheets of white paper.

Hypothesis 1.0 was accepted based on good correlation values. The scatter plots in Figures 1, 3, 5, 7 support the conclusion. The plots show a linear relationship.

2.0 There is a relationship between a subjective ranking and an instrument generated CIE whiteness response that is ranked for a group of 128 sheets of white paper.

Hypothesis 2.0 was accepted based on strong correlation values. The scatter plots in Figures 2, 4, 6, 8 support the conclusion. The plots show a linear relationship.

Additional Conclusions

Further conclusions may be drawn from the plots and correlation values:

- 1) CIE Whiteness Index is a better predictor of visual response than CIELAB L*. The visual ranking when compared to the CIE Whiteness Index rankings had higher correlation coefficients than when the visual ranking was compared to the CIELAB L* rankings.
- 2) The Y, x, y measurements from the X-Rite 948 yielded CIE Whiteness Index values that were better predictors of whiteness when compared to the visual ranking than the values obtained from the Minolta CR-200b. The calculated CIE whiteness values using data from the X-Rite 948 have higher correlation coefficients than the same calculated values using data from the Minolta CR-200b. This is also shown by Figures 6 and 8 when compared to Figures 2 and 4.
- 3) The correlations between the visual ranking and the CIE whiteness rankings generated with the hand held instruments, were not quite as strong as the correlations were between the rankings made with the equipment used by Jordan and O'Neill. The strongest correlation coefficient from this study had a value of .953 for r using the instrument (X-Rite 948) equipped with a gas filled tungsten lamp. Jordan and O'Neill had stronger correlations with values of

.969 for r , calculated from an r^2 of .94, when using equipment having a quartz-tungsten lamp as a source.¹ While the correlation coefficients for the rankings generated with the hand held instruments are not as high as the coefficients for the rankings generated with equipment used by Jordan and O'Neill, the coefficients of both rankings indicate that the rankings produced with the hand held equipment are very similar to those made by Jordan and O'Neill.

4) The selection of Illuminants C or D₆₅ did not have much effect on the data obtained. The correlations of data sets with the same color spaces but different illuminants have similar correlation values. This is especially true with CIELAB L*.

A known major difference between the instruments was the light source. The Minolta uses a pulsed xenon lamp and the X-Rite uses a gas filled tungsten lamp. The CIE whiteness values generated with the tungsten lamp more closely fit the visual ranking. This can be seen in the correlation values with the X-Rite 948 having the highest values. Jordan and O'Neill found a similar result.²

Recommendations for Further Investigation

A period of two years elapsed from when this study began and the measurements were made. The results of this study could be compared to the results

of Jordan and O'Neill to try and determine if any color change occurred in the sample sheets due to time. The sheets were stored in a light tight carton in an office for the two year period. Another approach would include gathering fresh samples and conducting both the visual ranking and instrument ranking in a much shorter period of time. The second approach would rule out the instrument differences that would occur in the first approach.

As is cited in much of the literature concerning colorimetry, measurements from instruments made by different manufacturers usually do not agree. The same problem will extend to the whiteness indices made from measurements from different instruments. More work for colorimetry is required in lamps for light sources, filters, and instrument agreement between manufacturers.

Endnotes for Chapter 6

1. B. D. Jordan and M. A. O'Neill, "The whiteness of paper -- colorimetry and visual ranking.", Tappi Journal (May 1991), p. 100.
2. Jordan and O'Neill, p. 100.

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Appendices

Appendix A

Minolta CR-200b with Illum. C displaying L^* vs. Visual Ranking

Appendix A

Minolta CR-200b with Illum. C displaying L* vs. Visual Ranking

```

AVG L* = @ROUND(@SUM(D16..D19)/4,2)
AVG a* = @ROUND(@SUM(E16..E19)/4,2)
AVG b* = @ROUND(@SUM(F16..F19)/4,2)

```

GRADE CODE	SAMPLE	L* ILL C MINOLTA	a* ILL C MINOLTA	b* ILL C MINOLTA
=====	=====	=====	=====	=====
1	1	97.10	-0.30	1.70
	2	97.00	-0.30	1.70
	L*	97.10	-0.20	1.60
	97.08	97.10	-0.20	1.70
	AVG	97.08	-0.25	1.68
2	1	96.40	-0.10	1.20
	2	96.30	0.00	1.20
	L*	96.50	-0.10	1.10
	96.40	96.40	-0.10	1.20
	AVG	96.40	-0.08	1.18
3	1	96.60	-0.80	4.30
	2	96.60	-0.70	4.30
	L*	96.70	-0.80	4.30
	96.65	96.70	-0.80	4.40
	AVG	96.65	-0.78	4.33
4	1	96.90	-0.90	3.60
	2	96.90	-0.08	3.70
	L*	96.60	-0.80	3.60
	96.78	96.70	-0.80	3.70
	AVG	96.78	-0.65	3.65
5	1	97.00	-0.40	3.20
	2	97.10	-0.40	3.20
	L*	96.70	-0.50	3.10
	96.93	96.90	-0.30	3.30
	AVG	96.93	-0.40	3.20
6	1	96.40	-0.20	2.80
	2	96.40	-0.40	2.90
	L*	95.90	-0.50	2.20
	96.30	96.50	-0.50	2.80
	AVG	96.30	-0.40	2.68

Appendix A (continued)

7		1	97.50	-0.50	2.10
		2	97.50	-0.40	2.10
	L*	3	97.50	-0.50	2.10
	97.48	4	97.40	-0.50	2.10
		AVG	97.48	-0.48	2.10
8		1	97.10	-0.50	2.40
		2	97.10	-0.30	2.40
	L*	3	97.20	-0.60	2.10
	97.18	4	97.30	-0.70	2.30
		AVG	97.18	-0.53	2.30
9		1	97.50	-0.50	1.80
		2	97.50	-0.50	1.80
	L*	3	97.50	-0.60	1.70
	97.48	4	97.40	-0.50	1.80
		AVG	97.48	-0.53	1.78
10		1	97.20	-0.40	2.00
		2	97.00	-0.30	2.20
	L*	3	97.00	-0.40	2.00
	97.13	4	97.30	-0.40	2.00
		AVG	97.13	-0.38	2.05
11		1	96.80	-0.40	3.10
		2	96.90	-0.50	3.10
	L*	3	97.00	-0.30	3.20
	96.93	4	97.00	-0.40	3.20
		AVG	96.93	-0.40	3.15
12		1	96.90	0.10	1.10
		2	96.90	0.00	1.30
	L*	3	97.00	-0.10	1.20
	96.93	4	96.90	0.00	1.20
		AVG	96.93	0.00	1.20
13		1	96.20	-0.40	5.40
		2	96.20	-0.30	5.50
	L*	3	96.00	-0.30	5.30
	96.13	4	96.10	-0.30	5.40
		AVG	96.13	-0.33	5.40
14		1	96.00	-0.40	5.80
		2	96.10	-0.60	5.90
	L*	3	96.10	-0.50	5.70
	96.08	4	96.10	-0.40	5.70
		AVG	96.08	-0.48	5.78

Appendix A (continued)

15		1	97.40	-0.40	2.10
		2	97.30	-0.20	2.20
	L*	3	97.30	-0.50	2.00
	97.33	4	97.30	-0.40	2.20
		AVG	97.33	-0.38	2.13
16		1	98.10	-0.40	1.50
		2	97.90	-0.40	1.50
	L*	3	97.90	-0.50	1.40
	98.00	4	98.10	-0.50	1.60
		AVG	98.00	-0.45	1.50
17		1	96.30	-0.90	4.40
		2	96.20	-0.90	4.30
	L*	3	96.20	-0.90	4.40
	96.23	4	96.20	-0.90	4.30
		AVG	96.23	-0.90	4.35
18		1	97.80	-0.30	1.20
		2	97.70	-0.20	1.10
	L*	3	97.70	-0.20	1.10
	97.73	4	97.70	-0.30	1.20
		AVG	97.73	-0.25	1.15
19		1	97.60	-0.20	1.90
		2	97.40	-0.40	1.90
	L*	3	97.20	-0.50	1.50
	97.38	4	97.30	-0.50	1.70
		AVG	97.38	-0.40	1.75
20		1	97.60	-1.00	4.90
		2	97.60	-1.10	5.00
	L*	3	97.60	-0.90	4.80
	97.60	4	97.60	-1.00	4.90
		AVG	97.60	-1.00	4.90
21		1	97.20	-0.90	5.40
		2	97.10	-0.80	5.30
	L*	3	97.00	-1.00	5.00
	97.03	4	96.80	-0.90	5.30
		AVG	97.03	-0.90	5.25
22		1	95.10	0.10	2.30
		2	95.10	0.10	2.30
	L*	3	95.10	0.10	2.40
	95.10	4	95.10	0.00	2.50
		AVG	95.10	0.08	2.38

Appendix A (continued)

23		1	94.90	0.00	2.60
		2	94.80	0.00	2.70
	L*	3	94.90	0.00	2.70
	94.88	4	94.90	0.00	2.60
		AVG	94.88	0.00	2.65
24		1	94.60	-0.20	2.50
		2	94.50	-0.20	2.50
	L*	3	94.50	-0.10	2.60
	94.55	4	94.60	-0.20	2.50
		AVG	94.55	-0.18	2.53
25		1	95.00	0.40	2.30
		2	95.00	0.40	2.30
	L*	3	95.20	0.30	2.40
	95.05	4	95.00	0.30	2.30
		AVG	95.05	0.35	2.33
26		1	94.80	0.10	2.10
		2	94.80	0.00	2.10
	L*	3	94.80	0.00	2.10
	94.78	4	94.70	0.20	2.00
		AVG	94.78	0.08	2.08
27		1	95.20	0.00	2.40
		2	95.10	0.10	2.40
	L*	3	95.10	0.00	2.40
	95.15	4	95.20	0.00	2.40
		AVG	95.15	0.03	2.40
28		1	94.90	0.10	2.10
		2	94.80	0.10	2.20
	L*	3	94.90	0.20	2.20
	94.85	4	94.80	0.10	2.30
		AVG	94.85	0.13	2.20
29		1	94.70	-0.20	2.10
		2	94.80	-0.10	2.10
	L*	3	94.80	-0.20	2.10
	94.70	4	94.50	-0.10	2.00
		AVG	94.70	-0.15	2.08
30		1	94.70	-0.10	0.10
		2	94.70	-0.20	0.10
	L*	3	94.70	-0.10	0.20
	94.68	4	94.60	-0.10	0.10
		AVG	94.68	-0.13	0.13

Appendix A (continued)

31	1	94.40	0.70	-0.50
	2	94.50	0.50	-0.50
	L*	3	94.50	0.60
	94.48	4	94.50	0.60
	AVG	94.48	0.60	-0.50
32	1	94.80	0.10	0.20
	2	94.80	0.00	0.40
	L*	3	94.80	0.10
	94.80	4	94.80	0.10
	AVG	94.80	0.08	0.35
33	1	94.60	0.00	0.40
	2	94.60	0.00	0.30
	L*	3	94.80	0.10
	94.65	4	94.60	0.10
	AVG	94.65	0.05	0.35
34	1	95.30	0.00	-0.50
	2	95.30	0.00	-0.50
	L*	3	95.30	0.00
	95.30	4	95.30	0.00
	AVG	95.30	0.00	-0.50
35	1	94.60	0.00	0.20
	2	94.50	0.00	0.10
	L*	3	94.60	0.00
	94.58	4	94.60	0.00
	AVG	94.58	0.00	0.18
36	1	95.10	0.00	0.70
	2	95.20	0.10	0.70
	L*	3	95.20	0.10
	95.18	4	95.20	0.00
	AVG	95.18	0.05	0.73
37	1	94.80	0.00	0.40
	2	94.80	-0.10	0.30
	L*	3	94.90	-0.20
	94.83	4	94.80	-0.20
	AVG	94.83	-0.13	0.38
38	1	93.40	-0.50	0.00
	2	93.40	-0.40	0.00
	L*	3	93.40	-0.40
	93.40	4	93.40	-0.40
	AVG	93.40	-0.43	0.00

Appendix A (continued)

39		1	93.80	-0.50	0.40
		2	93.80	-0.70	0.50
	L*	3	93.80	-0.60	0.50
	93.80	4	93.80	-0.50	0.40
		AVG	93.80	-0.58	0.45
40		1	93.10	-0.50	0.10
		2	93.10	-0.50	0.10
	L*	3	93.10	-0.50	0.10
	93.10	4	93.10	-0.60	0.20
		AVG	93.10	-0.53	0.13
41		1	93.80	-0.70	0.10
		2	93.80	-0.70	0.20
	L*	3	93.90	-0.60	0.20
	93.85	4	93.90	-0.70	0.00
		AVG	93.85	-0.68	0.13
42		1	93.20	-0.40	1.40
		2	93.30	-0.40	1.40
	L*	3	93.20	-0.40	1.40
	93.20	4	93.10	-0.30	1.40
		AVG	93.20	-0.38	1.40
43		1	93.00	-0.90	1.90
		2	93.00	-0.90	1.90
	L*	3	93.00	-0.90	1.90
	93.00	4	93.00	-0.80	1.90
		AVG	93.00	-0.88	1.90
44		1	93.30	-0.30	1.50
		2	93.20	-5.00	1.50
	L*	3	93.20	-0.50	1.50
	93.28	4	93.40	-0.50	1.50
		AVG	93.28	-1.58	1.50
45		1	97.70	-0.10	0.30
		2	97.70	0.00	0.40
	L*	3	97.60	0.00	0.20
	97.63	4	97.50	0.00	0.30
		AVG	97.63	-0.03	0.30
46		1	98.00	-0.10	0.60
		2	98.00	-0.10	0.60
	L*	3	97.70	-0.20	0.30
	97.90	4	97.90	0.00	0.60
		AVG	97.90	-0.10	0.53

Appendix A (continued)

47		1	97.90	0.00	0.80
		2	97.90	0.00	0.80
	L*	3	97.30	-0.10	0.30
	97.60	4	97.30	0.00	0.70
		AVG	97.60	-0.03	0.65
48		1	97.90	0.00	0.80
		2	97.90	0.10	1.00
	L*	3	97.50	0.00	0.50
	97.78	4	97.80	0.10	0.90
		AVG	97.78	0.05	0.80
49		1	98.10	-0.20	0.60
		2	98.00	-0.20	0.60
	L*	3	98.00	-0.20	0.40
	98.00	4	97.90	-0.20	0.50
		AVG	98.00	-0.20	0.53
50		1	97.50	0.00	0.90
		2	97.00	0.00	0.60
	L*	3	97.00	0.00	0.50
	97.18	4	97.20	-0.10	0.70
		AVG	97.18	-0.03	0.68
51		1	95.30	0.40	2.10
		2	95.30	0.30	2.20
	L*	3	95.30	0.40	2.10
	95.28	4	95.20	0.30	2.10
		AVG	95.28	0.35	2.13
52		1	95.50	0.30	1.80
		2	95.90	0.30	1.90
	L*	3	94.80	0.00	1.30
	95.35	4	95.20	0.20	1.90
		AVG	95.35	0.20	1.73
53		1	95.10	0.10	1.20
		2	95.00	0.10	1.20
	L*	3	95.10	0.00	1.20
	95.08	4	95.10	0.20	1.30
		AVG	95.08	0.10	1.23
54		1	96.40	-0.10	0.10
		2	96.40	-0.30	0.30
	L*	3	96.40	-0.20	0.20
	96.43	4	96.50	-0.10	0.10
		AVG	96.43	-0.18	0.18

Appendix A (continued)

55		1	96.50	-0.20	2.50
		2	96.50	0.00	2.50
	L*	3	96.60	-0.30	2.20
	96.53	4	96.50	-0.20	2.60
		AVG	96.53	-0.18	2.45
56		1	95.50	0.50	2.60
		2	95.20	0.50	2.60
	L*	3	95.40	0.40	2.40
	95.38	4	95.40	0.30	2.60
		AVG	95.38	0.43	2.55
57		1	95.10	0.70	-2.10
		2	95.10	0.60	-2.10
	L*	3	95.10	0.60	-2.10
	95.10	4	95.10	0.60	-2.00
		AVG	95.10	0.63	-2.08
58		1	94.20	0.30	-2.20
		2	94.20	0.40	-2.10
	L*	3	94.30	0.30	-2.00
	94.23	4	94.20	0.40	-2.20
		AVG	94.23	0.35	-2.13
59		1	97.50	-0.50	1.60
		2	97.60	-0.50	1.60
	L*	3	97.60	-0.50	1.60
	97.58	4	97.60	-0.40	1.50
		AVG	97.58	-0.48	1.58
60		1	97.00	-0.40	2.80
		2	97.00	-0.50	2.90
	L*	3	97.00	-0.50	2.90
	96.98	4	96.90	-0.50	2.80
		AVG	96.98	-0.48	2.85
61		1	98.10	-0.40	0.90
		2	97.90	-0.60	0.90
	L*	3	97.00	-0.50	0.20
	97.75	4	98.00	-0.60	1.00
		AVG	97.75	-0.53	0.75
62		1	98.60	-0.40	0.60
		2	98.40	-0.40	0.50
	L*	3	97.70	-0.40	0.10
	98.20	4	98.10	-0.40	0.20
		AVG	98.20	-0.40	0.35

Appendix A (continued)

63		1	96.20	-0.90	1.90
		2	96.20	-0.80	1.80
	L*	3	96.20	-0.90	1.90
	96.20	4	96.20	-0.80	2.00
		AVG	96.20	-0.85	1.90
64		1	92.90	-0.60	1.00
		2	92.90	-0.60	1.10
	L*	3	92.90	-0.70	1.00
	92.90	4	92.90	-0.70	1.00
		AVG	92.90	-0.65	1.03
65		1	96.90	-0.10	-0.30
		2	96.90	0.10	-0.50
	L*	3	96.40	0.00	-0.50
	96.80	4	97.00	-0.10	-0.40
		AVG	96.80	-0.03	-0.43
66		1	92.40	0.10	-0.10
		2	92.40	0.10	0.00
	L*	3	92.30	0.10	0.00
	92.38	4	92.40	0.20	0.00
		AVG	92.38	0.13	-0.03
67		1	93.20	-0.40	2.00
		2	93.20	-0.50	1.90
	L*	3	93.10	-0.40	1.90
	93.18	4	93.20	-0.50	2.00
		AVG	93.18	-0.45	1.95
68		1	98.00	-0.70	1.20
		2	98.00	-0.50	1.30
	L*	3	98.00	-0.70	1.20
	98.00	4	98.00	-0.50	1.00
		AVG	98.00	-0.60	1.18
69		1	96.70	-1.00	3.80
		2	96.60	-0.90	3.60
	L*	3	96.60	-0.90	3.70
	96.65	4	96.70	-1.10	3.70
		AVG	96.65	-0.98	3.70
70		1	96.40	-0.90	4.90
		2	96.40	-0.80	4.90
	L*	3	96.40	-0.80	4.80
	96.40	4	96.40	-0.80	4.90
		AVG	96.40	-0.83	4.88

Appendix A (continued)

71		1	96.70	-0.20	1.90
		2	96.70	-0.20	1.90
	L*	3	96.70	-0.20	1.90
	96.70	4	96.70	-0.30	1.80
		AVG	96.70	-0.23	1.88
72		1	96.80	-0.30	1.90
		2	96.80	-0.30	1.90
	L*	3	96.80	-0.30	1.70
	96.78	4	96.70	-0.20	1.90
		AVG	96.78	-0.28	1.85
73		1	96.70	-1.00	4.40
		2	96.70	-1.00	4.40
	L*	3	96.70	-1.00	4.30
	96.70	4	96.70	-0.90	4.30
		AVG	96.70	-0.98	4.35
74		1	96.70	-1.30	5.50
		2	96.70	-1.30	5.40
	L*	3	96.80	-1.30	5.40
	96.73	4	96.70	-1.30	5.40
		AVG	96.73	-1.30	5.43
75		1	96.70	-0.30	1.00
		2	96.70	-0.30	1.00
	L*	3	96.50	-0.20	0.80
	96.63	4	96.60	-0.30	1.00
		AVG	96.63	-0.28	0.95
76		1	96.50	-0.30	1.70
		2	96.50	-0.30	1.70
	L*	3	96.60	-0.30	1.60
	96.50	4	96.40	-0.20	1.90
		AVG	96.50	-0.28	1.73
77		1	94.80	0.10	2.50
		2	94.90	0.00	2.60
	L*	3	94.90	0.00	2.50
	94.88	4	94.90	0.00	2.50
		AVG	94.88	0.03	2.53
78		1	94.50	0.00	2.10
		2	94.60	0.00	2.10
	L*	3	94.60	-0.10	2.10
	94.55	4	94.50	0.00	2.20
		AVG	94.55	-0.03	2.13

Appendix A (continued)

79		1	94.30	-0.20	2.40
		2	94.30	-0.20	2.40
	L*	3	94.40	-0.20	2.40
	94.33	4	94.30	-0.20	2.40
		AVG	94.33	-0.20	2.40
80		1	96.30	0.40	1.60
		2	96.30	0.30	1.60
	L*	3	96.50	0.30	1.50
	96.38	4	96.40	0.30	1.60
		AVG	96.38	0.33	1.58
81		1	94.40	0.00	2.50
		2	94.40	0.00	2.60
	L*	3	94.30	0.00	2.70
	94.35	4	94.30	0.00	2.60
		AVG	94.35	0.00	2.60
82		1	92.30	-0.60	2.10
		2	92.30	-0.60	2.00
	L*	3	92.30	-0.50	2.00
	92.28	4	92.20	-0.60	2.10
		AVG	92.28	-0.58	2.05
83		1	95.40	0.00	2.40
		2	95.40	-0.10	2.60
	L*	3	95.50	-0.10	2.60
	95.40	4	95.30	0.00	2.60
		AVG	95.40	-0.05	2.55
84		1	93.70	0.60	0.80
		2	93.70	0.60	0.80
	L*	3	93.70	0.50	0.90
	93.70	4	93.70	0.40	0.90
		AVG	93.70	0.53	0.85
85		1	96.30	-0.30	3.00
		2	96.30	-0.40	3.10
	L*	3	96.40	-0.40	3.10
	96.38	4	96.50	-0.40	3.10
		AVG	96.38	-0.38	3.08
86		1	96.60	-0.50	3.40
		2	96.60	-0.60	3.30
	L*	3	96.40	-0.50	3.10
	96.55	4	96.60	-0.50	3.50
		AVG	96.55	-0.53	3.33

Appendix A (continued)

87	1	92.10	0.00	0.30
	2	92.10	-0.10	0.40
	L*	3	92.10	0.00
	92.13	4	92.20	0.00
	AVG	92.13	-0.03	0.43
88	1	94.70	-0.70	2.40
	2	94.70	-0.70	2.40
	L*	3	94.70	-0.70
	94.70	4	94.70	-0.70
	AVG	94.70	-0.70	2.40
89	1	93.70	-0.70	2.50
	2	93.70	-0.60	2.30
	L*	3	93.70	-0.50
	93.68	4	93.60	-0.50
	AVG	93.68	-0.58	2.40
90	1	97.70	0.10	1.00
	2	97.50	0.10	0.90
	L*	3	97.70	0.20
	97.65	4	97.70	0.10
	AVG	97.65	0.13	0.90
91	1	93.30	-0.50	1.10
	2	93.40	-0.40	1.00
	L*	3	93.40	-0.40
	93.38	4	93.40	-0.40
	AVG	93.38	-0.43	1.08
92	1	94.50	-0.30	1.20
	2	94.50	-0.20	1.20
	L*	3	94.50	-0.30
	94.53	4	94.60	-0.20
	AVG	94.53	-0.25	1.20
93	1	95.90	-0.60	4.40
	2	95.90	-0.50	4.40
	L*	3	95.90	-0.40
	95.90	4	95.90	-0.50
	AVG	95.90	-0.50	4.40
94	1	96.20	-0.10	1.60
	2	96.00	0.00	1.70
	L*	3	96.20	-0.10
	96.15	4	96.20	-0.10
	AVG	96.15	-0.08	1.55

Appendix A (continued)

95		1	94.60	-0.60	0.60
		2	94.50	-0.50	0.70
	L*	3	94.60	-0.50	0.70
	94.58	4	94.60	-0.50	0.70
		AVG	94.58	-0.53	0.68
96		1	94.50	0.20	1.50
		2	94.40	0.20	1.40
	L*	3	94.50	0.20	1.40
	94.45	4	94.40	0.30	1.40
		AVG	94.45	0.23	1.43
97		1	92.70	0.70	0.40
		2	92.80	0.80	0.40
	L*	3	92.80	0.80	0.30
	92.78	4	92.80	0.80	0.40
		AVG	92.78	0.78	0.38
98		1	94.10	-0.90	2.30
		2	94.20	-0.80	2.20
	L*	3	94.20	-0.80	2.20
	94.30	4	94.70	-0.80	2.30
		AVG	94.30	-0.83	2.25
99		1	96.10	-0.30	2.60
		2	96.00	-0.30	2.60
	L*	3	96.00	-0.30	2.50
	96.03	4	96.00	-0.20	2.50
		AVG	96.03	-0.28	2.55
100		1	97.40	0.30	1.50
		2	97.40	0.20	1.60
	L*	3	97.50	0.20	1.30
	97.45	4	97.50	0.30	1.60
		AVG	97.45	0.25	1.50
101		1	95.80	-0.10	0.30
		2	95.80	0.00	0.30
	L*	3	95.80	-0.10	0.20
	95.80	4	95.80	-0.10	0.00
		AVG	95.80	-0.08	0.20
102		1	93.40	-1.10	2.50
		2	93.30	-1.10	2.60
	L*	3	93.30	-1.10	2.60
	93.35	4	93.40	-1.10	2.60
		AVG	93.35	-1.10	2.58

Appendix A (continued)

103	1	95.10	0.10	1.70
	2	95.10	0.10	1.70
	L*	3	95.10	0.10
	95.10	4	95.10	0.10
	AVG	95.10	0.10	1.70
104	1	95.30	-0.30	1.70
	2	95.20	-0.50	1.70
	L*	3	95.30	-0.40
	95.30	4	95.40	-0.40
	AVG	95.30	-0.40	1.75
105	1	95.40	-0.30	0.50
	2	95.50	-0.30	0.60
	L*	3	95.50	-0.30
	95.48	4	95.50	-0.40
	AVG	95.48	-0.33	0.53
106	1	94.50	0.20	0.80
	2	94.60	0.10	0.90
	L*	3	94.80	0.20
	94.65	4	94.70	0.20
	AVG	94.65	0.18	0.85
107	1	96.10	-0.60	2.60
	2	95.90	-0.60	2.40
	L*	3	95.90	-0.70
	95.93	4	95.80	-0.80
	AVG	95.93	-0.68	2.50
108	1	95.40	-0.30	2.50
	2	95.30	-0.30	2.40
	L*	3	95.30	-0.20
	95.35	4	95.40	-0.20
	AVG	95.35	-0.25	2.45
109	1	94.40	-0.30	2.70
	2	94.30	-0.20	2.50
	L*	3	94.40	-0.20
	94.40	4	94.50	-0.30
	AVG	94.40	-0.25	2.60
110	1	93.70	-0.40	0.00
	2	93.70	-0.40	-0.10
	L*	3	93.80	-0.40
	93.73	4	93.70	-0.50
	AVG	93.73	-0.43	-0.10

Appendix A (continued)

111	1	92.80	0.30	1.20
	2	92.80	0.30	1.30
	L*	3	92.90	0.20
	92.80	4	92.70	0.20
	AVG	92.80	0.25	1.33
112	1	92.90	-0.30	1.40
	2	92.90	-0.30	1.40
	L*	3	93.00	-0.30
	92.93	4	92.90	-0.30
	AVG	92.93	-0.30	1.43
113	1	94.60	0.20	1.30
	2	94.30	0.20	1.30
	L*	3	94.60	0.20
	94.50	4	94.50	0.30
	AVG	94.50	0.23	1.28
114	1	95.60	0.40	2.70
	2	95.50	0.40	2.70
	L*	3	95.60	0.40
	95.58	4	95.60	0.40
	AVG	95.58	0.40	2.70
115	1	96.00	0.20	1.20
	2	95.80	0.30	1.10
	L*	3	95.90	0.30
	95.88	4	95.80	0.30
	AVG	95.88	0.28	1.18
116	1	95.90	-0.90	2.00
	2	96.00	-1.00	1.80
	L*	3	95.90	-0.90
	95.93	4	95.90	-0.90
	AVG	95.93	-0.93	1.93
117	1	97.10	-0.20	2.60
	2	97.00	-0.30	2.40
	L*	3	97.00	-0.30
	97.05	4	97.10	-0.20
	AVG	97.05	-0.25	2.53
118	1	93.60	-0.30	0.80
	2	93.60	-0.30	0.80
	L*	3	93.60	-0.30
	93.58	4	93.50	-0.40
	AVG	93.58	-0.33	0.83

Appendix A (continued)

119	1	93.70	-0.60	1.40
	2	93.60	-0.70	1.40
L*	3	93.70	-0.70	1.30
93.65	4	93.60	-0.60	1.40
	AVG	93.65	-0.65	1.38
120	1	93.50	-0.70	1.10
	2	93.40	-0.70	1.10
L*	3	93.20	-0.70	1.10
93.30	4	93.10	-0.70	1.20
	AVG	93.30	-0.70	1.13
121	1	94.80	-0.70	1.40
	2	94.70	-0.50	1.40
L*	3	94.70	-0.60	1.40
94.75	4	94.80	-0.70	1.40
	AVG	94.75	-0.63	1.40
122	1	95.80	-0.30	1.50
	2	95.70	-0.30	1.60
L*	3	95.80	-0.40	1.50
95.75	4	95.70	-0.30	1.60
	AVG	95.75	-0.33	1.55
123	1	94.70	-0.70	3.00
	2	94.60	-0.60	3.00
L*	3	94.70	-0.70	3.00
94.68	4	94.70	-0.70	3.00
	AVG	94.68	-0.68	3.00
124	1	96.30	0.00	1.40
	2	96.30	0.20	1.40
L*	3	96.30	0.10	1.30
96.30	4	96.30	0.10	1.40
	AVG	96.30	0.10	1.38
125	1	93.40	-0.70	2.00
	2	93.40	-0.80	1.90
L*	3	93.50	-0.90	2.00
93.45	4	93.50	-0.80	2.00
	AVG	93.45	-0.80	1.98
126	1	92.80	0.60	1.10
	2	92.90	0.50	1.30
L*	3	92.80	0.60	1.10
92.83	4	92.80	0.50	1.30
	AVG	92.83	0.55	1.20

Appendix A (continued)

127	1	98.30	-0.30	0.30
	2	98.30	-0.30	0.40
L*	3	98.30	-0.40	0.30
98.25	4	98.10	-0.30	0.10
	AVG	98.25	-0.33	0.28
128	1	93.90	0.00	1.50
	2	93.90	0.10	1.40
L*	3	94.00	0.10	1.30
93.93	4	93.90	0.10	1.50
	AVG	93.93	0.08	1.43

Appendix B

Minolta with Illum. C and calc. WI from Y, x, y vs. Visual Ranking

Appendix B

Minolta with Illum. C and calc. WI from Y, x, y vs. Visual Ranking

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CIE WI= @ROUND((D20)+(800*(0.3101-(E20)))+(
          (1700*(0.3163-(F20))),2)
AVG Y = @ROUND((@SUM(D16..D19)/4),2)
AVG x = @ROUND((@SUM(E16..E19)/4),4)
AVG y = @ROUND((@SUM(F16..F19)/4),4)

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GRADE CODE	SAMPLE	Y ILL C MINOLTA	x ILL C MINOLTA	y ILL C MINOLTA
=====	=====	=====	=====	=====
1	1	93.10	0.3130	0.3190
	2	92.80	0.3130	0.3190
CIE WI	3	93.00	0.3130	0.3190
86.07	4	93.00	0.3130	0.3190
	AVG	92.98	0.3130	0.3190
2	1	91.20	0.3120	0.3180
	2	91.00	0.3120	0.3180
CIE WI	3	91.40	0.3120	0.3180
86.79	4	91.20	0.3120	0.3180
	AVG	91.20	0.3120	0.3180
3	1	91.70	0.3170	0.3240
	2	91.80	0.3170	0.3240
CIE WI	3	91.90	0.3160	0.3240
73.38	4	91.90	0.3170	0.3240
	AVG	91.83	0.3168	0.3240
4	1	92.40	0.3150	0.3230
	2	92.40	0.3150	0.3230
CIE WI	3	91.90	0.3150	0.3230
76.89	4	92.10	0.3150	0.3230
	AVG	92.20	0.3150	0.3230
5	1	92.70	0.3150	0.3220
	2	92.90	0.3150	0.3220
CIE WI	3	92.00	0.3150	0.3220
78.87	4	92.30	0.3150	0.3220
	AVG	92.48	0.3150	0.3220
6	1	91.30	0.3150	0.3210
	2	91.20	0.3150	0.3210
CIE WI	3	90.00	0.3130	0.3200
79.99	4	91.50	0.3140	0.3210
	AVG	91.00	0.3143	0.3208

Appendix B (continued)

7	1	93.90	0.3130	0.3200
	2	94.00	0.3130	0.3200
CIE WI	3	93.90	0.3130	0.3200
85.27	4	93.70	0.3130	0.3200
	AVG	93.88	0.3130	0.3200
8	1	93.10	0.3140	0.3210
	2	93.00	0.3140	0.3200
CIE WI	3	93.20	0.3130	0.3200
83.71	4	93.60	0.3130	0.3200
	AVG	93.23	0.3135	0.3203
9	1	93.90	0.3120	0.3190
	2	93.90	0.3130	0.3190
CIE WI	3	94.00	0.3120	0.3190
87.53	4	93.70	0.3120	0.3190
	AVG	93.88	0.3123	0.3190
10	1	93.20	0.3130	0.3200
	2	92.60	0.3130	0.3200
CIE WI	3	92.80	0.3130	0.3200
84.39	4	93.40	0.3130	0.3200
	AVG	93.00	0.3130	0.3200
11	1	92.30	0.3150	0.3220
	2	92.60	0.3150	0.3220
CIE WI	3	92.70	0.3150	0.3220
78.99	4	92.80	0.3150	0.3220
	AVG	92.60	0.3150	0.3220
12	1	92.40	0.3120	0.3180
	2	92.40	0.3120	0.3180
CIE WI	3	92.80	0.3120	0.3180
88.12	4	92.50	0.3120	0.3180
	AVG	92.53	0.3120	0.3180
13	1	90.70	0.3190	0.3260
	2	90.60	0.3190	0.3260
CIE WI	3	90.30	0.3190	0.3260
66.94	4	90.60	0.3190	0.3260
	AVG	90.55	0.3190	0.3260
14	1	90.30	0.3200	0.3270
	2	90.50	0.3200	0.3270
CIE WI	3	90.60	0.3200	0.3270
64.39	4	90.60	0.3200	0.3270
	AVG	90.50	0.3200	0.3270

Appendix B (continued)

15	1	93.60	0.3130	0.3200
	2	93.40	0.3140	0.3200
CIE WI	3	93.40	0.3130	0.3200
84.63	4	93.50	0.3130	0.3200
	AVG	93.48	0.3133	0.3200
16	1	95.40	0.3120	0.3190
	2	95.10	0.3120	0.3190
CIE WI	3	94.90	0.3120	0.3190
89.09	4	95.40	0.3120	0.3190
	AVG	95.20	0.3120	0.3190
17	1	91.00	0.3170	0.3240
	2	90.80	0.3170	0.3240
CIE WI	3	90.80	0.3170	0.3240
72.40	4	90.80	0.3160	0.3240
	AVG	90.85	0.3168	0.3240
18	1	94.70	0.3120	0.3180
	2	94.40	0.3120	0.3180
CIE WI	3	94.40	0.3120	0.3180
90.12	4	94.60	0.3120	0.3180
	AVG	94.53	0.3120	0.3180
19	1	94.20	0.3130	0.3190
	2	93.80	0.3130	0.3190
CIE WI	3	93.30	0.3120	0.3190
86.93	4	93.40	0.3130	0.3190
	AVG	93.68	0.3128	0.3190
20	1	94.20	0.3170	0.3250
	2	94.20	0.3170	0.3260
CIE WI	3	94.10	0.3170	0.3250
73.36	4	94.20	0.3170	0.3250
	AVG	94.18	0.3170	0.3253
21	1	93.30	0.3190	0.3260
	2	93.00	0.3180	0.3260
CIE WI	3	92.70	0.3170	0.3260
69.99	4	92.20	0.3180	0.3260
	AVG	92.80	0.3180	0.3260
22	1	88.10	0.3140	0.3200
	2	88.20	0.3140	0.3200
CIE WI	3	88.00	0.3150	0.3200
78.29	4	88.10	0.3150	0.3200
	AVG	88.10	0.3145	0.3200

Appendix B (continued)

23	1	87.50	0.3150	0.3210
	2	87.30	0.3150	0.3210
CIE WI	3	87.60	0.3150	0.3210
75.57	4	87.50	0.3150	0.3210
	AVG	87.48	0.3150	0.3210
24	1	87.00	0.3140	0.3210
	2	86.70	0.3140	0.3210
CIE WI	3	86.70	0.3150	0.3210
75.48	4	86.90	0.3140	0.3210
	AVG	86.83	0.3143	0.3210
25	1	87.90	0.3150	0.3200
	2	87.90	0.3150	0.3200
CIE WI	3	88.30	0.3150	0.3200
77.77	4	87.80	0.3150	0.3200
	AVG	87.98	0.3150	0.3200
26	1	87.30	0.3140	0.3200
	2	87.30	0.3140	0.3200
CIE WI	3	87.30	0.3140	0.3200
77.87	4	87.20	0.3140	0.3200
	AVG	87.28	0.3140	0.3200
27	1	88.30	0.3140	0.3200
	2	88.10	0.3140	0.3200
CIE WI	3	88.20	0.3140	0.3200
78.79	4	88.20	0.3140	0.3200
	AVG	88.20	0.3140	0.3200
28	1	87.60	0.3140	0.3200
	2	87.40	0.3140	0.3200
CIE WI	3	87.70	0.3140	0.3200
78.12	4	87.40	0.3140	0.3200
	AVG	87.53	0.3140	0.3200
29	1	87.20	0.3130	0.3200
	2	87.40	0.3140	0.3200
CIE WI	3	87.40	0.3130	0.3200
78.35	4	86.80	0.3130	0.3200
	AVG	87.20	0.3133	0.3200
30	1	87.20	0.3100	0.3160
	2	87.10	0.3100	0.3160
CIE WI	3	87.20	0.3100	0.3160
87.72	4	87.00	0.3100	0.3160
	AVG	87.13	0.3100	0.3160

Appendix B (continued)

31	1	86.50	0.3100	0.3140
	2	86.70	0.3100	0.3140
CIE WI	3	86.60	0.3100	0.3140
90.59	4	86.60	0.3100	0.3140
	AVG	86.60	0.3100	0.3140
32	1	87.40	0.3110	0.3160
	2	87.50	0.3110	0.3170
CIE WI	3	87.50	0.3110	0.3170
85.88	4	87.40	0.3110	0.3170
	AVG	87.45	0.3110	0.3168
33	1	86.90	0.3110	0.3170
	2	87.00	0.3110	0.3170
CIE WI	3	87.40	0.3110	0.3160
85.51	4	87.00	0.3110	0.3170
	AVG	87.08	0.3110	0.3168
34	1	88.60	0.3090	0.3150
	2	88.50	0.3090	0.3150
CIE WI	3	88.60	0.3090	0.3150
91.67	4	88.60	0.3090	0.3150
	AVG	88.58	0.3090	0.3150
35	1	86.90	0.3100	0.3160
	2	86.70	0.3100	0.3160
CIE WI	3	86.90	0.3100	0.3160
87.44	4	86.90	0.3100	0.3160
	AVG	86.85	0.3100	0.3160
36	1	88.20	0.3110	0.3170
	2	88.40	0.3110	0.3170
CIE WI	3	88.40	0.3110	0.3170
86.39	4	88.20	0.3110	0.3170
	AVG	88.30	0.3110	0.3170
37	1	87.30	0.3110	0.3170
	2	87.40	0.3100	0.3170
CIE WI	3	87.50	0.3100	0.3170
86.08	4	87.50	0.3100	0.3170
	AVG	87.43	0.3103	0.3170
38	1	84.20	0.3090	0.3160
	2	84.20	0.3090	0.3160
CIE WI	3	84.20	0.3090	0.3160
85.57	4	84.10	0.3090	0.3160
	AVG	84.18	0.3090	0.3160

Appendix B (continued)

39	1	85.00	0.3100	0.3170
	2	85.10	0.3100	0.3170
CIE WI	3	85.10	0.3100	0.3170
83.94	4	85.00	0.3100	0.3170
	AVG	85.05	0.3100	0.3170
40	1	83.50	0.3090	0.3160
	2	83.50	0.3090	0.3160
CIE WI	3	83.40	0.3090	0.3160
84.36	4	83.50	0.3090	0.3170
	AVG	83.48	0.3090	0.3163
41	1	85.00	0.3090	0.3170
	2	85.00	0.3090	0.3170
CIE WI	3	85.20	0.3100	0.3170
84.89	4	85.20	0.3090	0.3160
	AVG	85.10	0.3093	0.3168
42	1	83.70	0.3120	0.3190
	2	83.80	0.3120	0.3190
CIE WI	3	83.60	0.3120	0.3190
77.57	4	83.60	0.3120	0.3190
	AVG	83.68	0.3120	0.3190
43	1	83.30	0.3120	0.3200
	2	83.30	0.3120	0.3200
CIE WI	3	83.30	0.3120	0.3200
75.47	4	83.20	0.3120	0.3200
	AVG	83.28	0.3120	0.3200
44	1	84.00	0.3120	0.3190
	2	83.80	0.3120	0.3190
CIE WI	3	83.60	0.3120	0.3190
77.77	4	84.10	0.3120	0.3190
	AVG	83.88	0.3120	0.3190
45	1	94.60	0.3100	0.3170
	2	94.60	0.3110	0.3170
CIE WI	3	94.30	0.3100	0.3160
93.90	4	94.10	0.3100	0.3160
	AVG	94.40	0.3103	0.3165
46	1	95.20	0.3110	0.3170
	2	95.20	0.3110	0.3170
CIE WI	3	94.60	0.3100	0.3170
93.25	4	95.00	0.3110	0.3170
	AVG	95.00	0.3108	0.3170

Appendix B (continued)

47	1	95.00	0.3110	0.3170
	2	95.00	0.3110	0.3170
CIE WI	3	93.40	0.3100	0.3170
92.45	4	93.40	0.3110	0.3170
	AVG	94.20	0.3108	0.3170
48	1	95.00	0.3110	0.3170
	2	94.90	0.3120	0.3170
CIE WI	3	93.90	0.3110	0.3170
92.34	4	94.80	0.3120	0.3170
	AVG	94.65	0.3115	0.3170
49	1	95.40	0.3110	0.3170
	2	95.30	0.3110	0.3170
CIE WI	3	95.20	0.3100	0.3170
93.50	4	95.10	0.3110	0.3170
	AVG	95.25	0.3108	0.3170
50	1	93.90	0.3120	0.3180
	2	92.80	0.3110	0.3170
CIE WI	3	92.80	0.3110	0.3170
90.52	4	93.20	0.3110	0.3170
	AVG	93.18	0.3113	0.3173
51	1	88.50	0.3140	0.3190
	2	88.70	0.3140	0.3200
CIE WI	3	88.60	0.3140	0.3190
79.99	4	88.40	0.3140	0.3200
	AVG	88.55	0.3140	0.3195
52	1	89.20	0.3140	0.3190
	2	89.30	0.3140	0.3190
CIE WI	3	87.40	0.3130	0.3180
81.37	4	88.40	0.3140	0.3190
	AVG	88.58	0.3138	0.3188
53	1	88.10	0.3120	0.3180
	2	88.00	0.3120	0.3180
CIE WI	3	88.10	0.3120	0.3180
83.40	4	88.00	0.3130	0.3180
	AVG	88.05	0.3123	0.3180
54	1	91.30	0.3100	0.3160
	2	91.30	0.3100	0.3170
CIE WI	3	91.30	0.3100	0.3160
91.41	4	91.40	0.3100	0.3160
	AVG	91.33	0.3100	0.3163

Appendix B (continued)

55	1	91.60	0.3140	0.3210
	2	91.60	0.3140	0.3200
CIE WI	3	91.70	0.3140	0.3200
81.34	4	91.50	0.3140	0.3210
	AVG	91.60	0.3140	0.3205
56	1	89.00	0.3150	0.3200
	2	88.20	0.3150	0.3200
CIE WI	3	88.80	0.3150	0.3200
78.52	4	88.90	0.3150	0.3200
	AVG	88.73	0.3150	0.3200
57	1	88.20	0.3070	0.3110
	2	88.10	0.3070	0.3110
CIE WI	3	88.10	0.3070	0.3110
99.11	4	88.10	0.3070	0.3120
	AVG	88.13	0.3070	0.3113
58	1	86.10	0.3060	0.3110
	2	86.00	0.3070	0.3120
CIE WI	3	86.20	0.3070	0.3120
97.14	4	86.10	0.3060	0.3110
	AVG	86.10	0.3065	0.3115
59	1	94.10	0.31	0.3190
	2	94.20	0.3120	0.3190
CIE WI	3	94.10	0.3120	0.3190
ERR	4	94.10	0.3120	0.3190
	AVG	94.44	0.6310	ERR
60	1	92.80	0.3140	0.3210
	2	92.70	0.3140	0.3220
CIE WI	3	92.80	0.3140	0.3220
80.74	4	92.50	0.3140	0.3210
	AVG	92.70	0.3140	0.3215
61	1	95.40	0.3110	0.3180
	2	94.90	0.3110	0.3180
CIE WI	3	92.70	0.3100	0.3170
91.44	4	95.20	0.3110	0.3180
	AVG	94.55	0.3108	0.3178
62	1	96.60	0.3110	0.3170
	2	96.20	0.3100	0.3170
CIE WI	3	94.50	0.3100	0.3160
94.67	4	95.40	0.3100	0.3170
	AVG	95.68	0.3103	0.3168

Appendix B (continued)

63	1	90.70	0.3120	0.3200
	2	90.70	0.3120	0.3200
CIE WI	3	90.70	0.3120	0.3200
82.89	4	90.70	0.3120	0.3200
	AVG	90.70	0.3120	0.3200
64	1	82.90	0.3110	0.3180
	2	83.00	0.3110	0.3180
CIE WI	3	82.90	0.3110	0.3180
79.34	4	83.00	0.3110	0.3180
	AVG	82.95	0.3110	0.3180
65	1	92.50	0.3090	0.3150
	2	92.50	0.3090	0.3150
CIE WI	3	91.30	0.3090	0.3150
95.32	4	92.60	0.3090	0.3150
	AVG	92.23	0.3090	0.3150
66	1	81.80	0.3100	0.3150
	2	81.80	0.3100	0.3160
CIE WI	3	81.70	0.3100	0.3160
82.71	4	81.80	0.3100	0.3160
	AVG	81.78	0.3100	0.3158
67	1	83.70	0.3130	0.3200
	2	83.70	0.3130	0.3200
CIE WI	3	83.50	0.3130	0.3200
75.02	4	83.60	0.3130	0.3200
	AVG	83.63	0.3130	0.3200
68	1	95.30	0.3110	0.3180
	2	95.20	0.3110	0.3180
CIE WI	3	95.20	0.3110	0.3180
91.64	4	95.30	0.3110	0.3180
	AVG	95.25	0.3110	0.3180
69	1	91.90	0.3150	0.3240
	2	91.90	0.3150	0.3230
CIE WI	3	91.80	0.3150	0.3230
76.08	4	92.00	0.3150	0.3230
	AVG	91.90	0.3150	0.3233
70	1	91.30	0.3170	0.3250
	2	91.20	0.3180	0.3250
CIE WI	3	91.20	0.3170	0.3250
70.52	4	91.20	0.3180	0.3250
	AVG	91.23	0.3175	0.3250

Appendix B (continued)

71	1	92.10	0.3130	0.3200
	2	92.00	0.3130	0.3190
CIE WI	3	92.10	0.3130	0.3200
84.29	4	92.00	0.3130	0.3190
	AVG	92.05	0.3130	0.3195
72	1	92.10	0.3130	0.3200
	2	92.20	0.3130	0.3200
CIE WI	3	92.20	0.3130	0.3190
83.88	4	92.10	0.3130	0.3200
	AVG	92.15	0.3130	0.3198
73	1	92.00	0.3160	0.3250
	2	91.90	0.3170	0.3250
CIE WI	3	91.90	0.3160	0.3240
73.05	4	92.00	0.3160	0.3240
	AVG	91.95	0.3163	0.3245
74	1	92.10	0.3180	0.3270
	2	92.00	0.3180	0.3270
CIE WI	3	92.20	0.3180	0.3270
67.57	4	92.00	0.3180	0.3270
	AVG	92.08	0.3180	0.3270
75	1	92.00	0.3110	0.3180
	2	91.90	0.3110	0.3180
CIE WI	3	91.50	0.3110	0.3170
88.56	4	91.90	0.3110	0.3180
	AVG	91.83	0.3110	0.3178
76	1	91.50	0.3130	0.3190
	2	91.50	0.3130	0.3190
CIE WI	3	91.70	0.3120	0.3190
84.73	4	91.20	0.3130	0.3190
	AVG	91.48	0.3128	0.3190
77	1	87.50	0.3150	0.3200
	2	87.60	0.3150	0.3210
CIE WI	3	87.60	0.3150	0.3200
76.52	4	87.60	0.3150	0.3210
	AVG	87.58	0.3150	0.3205
78	1	86.80	0.3140	0.3200
	2	86.80	0.3140	0.3200
CIE WI	3	87.00	0.3140	0.3200
77.39	4	86.60	0.3140	0.3200
	AVG	86.80	0.3140	0.3200

Appendix B (continued)

79	1	86.30	0.3140	0.3210
	2	86.10	0.3140	0.3210
CIE WI	3	86.50	0.3140	0.3200
76.04	4	86.30	0.3140	0.3200
	AVG	86.30	0.3140	0.3205
80	1	91.10	0.3130	0.3190
	2	91.00	0.3130	0.3190
CIE WI	3	91.40	0.3130	0.3180
84.61	4	91.20	0.3130	0.3190
	AVG	91.18	0.3130	0.3188
81	1	86.40	0.3150	0.3210
	2	86.50	0.3150	0.3210
CIE WI	3	86.30	0.3150	0.3210
74.47	4	86.30	0.3150	0.3210
	AVG	86.38	0.3150	0.3210
82	1	81.70	0.3130	0.3200
	2	81.50	0.3130	0.3200
CIE WI	3	81.60	0.3130	0.3200
72.94	4	81.40	0.3130	0.3200
	AVG	81.55	0.3130	0.3200
83	1	88.80	0.3140	0.3200
	2	89.00	0.3150	0.3210
CIE WI	3	89.00	0.3150	0.3210
77.47	4	88.70	0.3150	0.3210
	AVG	88.88	0.3148	0.3208
84	1	84.80	0.3120	0.3170
	2	84.70	0.3120	0.3170
CIE WI	3	84.90	0.3120	0.3170
82.09	4	84.80	0.3120	0.3170
	AVG	84.80	0.3120	0.3170
85	1	91.00	0.3150	0.3220
	2	91.00	0.3150	0.3220
CIE WI	3	91.30	0.3150	0.3220
77.62	4	91.60	0.3150	0.3220
	AVG	91.23	0.3150	0.3220
86	1	91.70	0.3150	0.3220
	2	91.60	0.3150	0.3220
CIE WI	3	91.30	0.3150	0.3220
77.46	4	91.70	0.3150	0.3230
	AVG	91.58	0.3150	0.3223

Appendix B (continued)

87	1	81.30	0.3110	0.3170
	2	81.10	0.3100	0.3170
CIE WI	3	81.30	0.3110	0.3170
79.50	4	81.30	0.3110	0.3170
	AVG	81.25	0.3108	0.3170
88	1	87.20	0.3130	0.3210
	2	87.10	0.3130	0.3210
CIE WI	3	87.10	0.3130	0.3210
76.82	4	87.10	0.3130	0.3210
	AVG	87.13	0.3130	0.3210
89	1	84.90	0.3140	0.3210
	2	84.80	0.3130	0.3210
CIE WI	3	84.90	0.3140	0.3210
73.85	4	84.60	0.3140	0.3210
	AVG	84.80	0.3138	0.3210
90	1	94.40	0.3120	0.3180
	2	94.30	0.3120	0.3170
CIE WI	3	94.40	0.3120	0.3170
91.16	4	94.40	0.3120	0.3170
	AVG	94.38	0.3120	0.3173
91	1	84.00	0.3110	0.3180
	2	84.10	0.3110	0.3180
CIE WI	3	84.10	0.3110	0.3180
80.47	4	84.10	0.3110	0.3180
	AVG	84.08	0.3110	0.3180
92	1	86.70	0.3120	0.3180
	2	86.80	0.3120	0.3180
CIE WI	3	86.70	0.3120	0.3180
82.37	4	86.90	0.3120	0.3180
	AVG	86.78	0.3120	0.3180
93	1	90.00	0.3170	0.3240
	2	90.00	0.3170	0.3240
CIE WI	3	90.10	0.3170	0.3240
71.44	4	90.10	0.3170	0.3240
	AVG	90.05	0.3170	0.3240
94	1	90.70	0.3130	0.3190
	2	90.40	0.3130	0.3190
CIE WI	3	90.70	0.3120	0.3180
84.24	4	90.80	0.3130	0.3190
	AVG	90.65	0.3128	0.3188

Appendix B (continued)

95	1	87.00	0.3100	0.3170
	2	86.80	0.3110	0.3180
CIE WI	3	86.90	0.3100	0.3180
84.17	4	86.80	0.3100	0.3180
	AVG	86.88	0.3103	0.3178
96	1	86.60	0.3130	0.3190
	2	86.50	0.3130	0.3180
CIE WI	3	86.70	0.3130	0.3180
80.86	4	86.50	0.3130	0.3180
	AVG	86.58	0.3130	0.3183
97	1	82.60	0.3120	0.3160
	2	82.70	0.3120	0.3160
CIE WI	3	82.80	0.3120	0.3160
81.69	4	82.70	0.3120	0.3160
	AVG	82.70	0.3120	0.3160
98	1	85.70	0.3130	0.3210
	2	85.90	0.3130	0.3210
CIE WI	3	86.10	0.3130	0.3210
75.62	4	86.00	0.3130	0.3210
	AVG	85.93	0.3130	0.3210
99	1	90.50	0.3140	0.3210
	2	90.40	0.3140	0.3210
CIE WI	3	90.40	0.3140	0.3210
79.32	4	90.40	0.3140	0.3210
	AVG	90.43	0.3140	0.3210
100	1	93.60	0.3130	0.3180
	2	93.80	0.3130	0.3190
CIE WI	3	94.00	0.3130	0.3180
87.79	4	94.00	0.3130	0.3190
	AVG	93.85	0.3130	0.3185
101	1	89.90	0.3100	0.3160
	2	89.80	0.3100	0.3160
CIE WI	3	89.80	0.3100	0.3160
90.42	4	89.80	0.3100	0.3160
	AVG	89.83	0.3100	0.3160
102	1	84.10	0.3130	0.3210
	2	83.80	0.3130	0.3210
CIE WI	3	83.80	0.3130	0.3210
73.67	4	84.20	0.3130	0.3210
	AVG	83.98	0.3130	0.3210

Appendix B (continued)

103	1	88.00	0.3130	0.3190
	2	88.10	0.3130	0.3190
CIE WI	3	88.10	0.3130	0.3190
81.19	4	88.20	0.3130	0.3190
	AVG	88.10	0.3130	0.3190
104	1	88.60	0.3120	0.3190
	2	88.40	0.3120	0.3190
CIE WI	3	88.60	0.3130	0.3190
82.09	4	88.80	0.3130	0.3190
	AVG	88.60	0.3125	0.3190
105	1	88.90	0.3100	0.3170
	2	89.00	0.3110	0.3170
CIE WI	3	89.00	0.3100	0.3170
87.68	4	89.20	0.3100	0.3170
	AVG	89.03	0.3103	0.3170
106	1	86.80	0.3120	0.3170
	2	86.90	0.3120	0.3170
CIE WI	3	87.50	0.3120	0.3170
84.39	4	87.20	0.3120	0.3170
	AVG	87.10	0.3120	0.3170
107	1	90.40	0.3140	0.3210
	2	90.10	0.3130	0.3210
CIE WI	3	90.00	0.3130	0.3210
81.75	4	98.70	0.3130	0.3210
	AVG	92.30	0.3133	0.3210
108	1	88.90	0.3140	0.3210
	2	88.60	0.3140	0.3200
CIE WI	3	88.60	0.3140	0.3200
78.49	4	88.90	0.3140	0.3210
	AVG	88.75	0.3140	0.3205
109	1	86.50	0.3150	0.3210
	2	86.20	0.3140	0.3210
CIE WI	3	86.40	0.3140	0.3210
75.08	4	86.60	0.3140	0.3210
	AVG	86.43	0.3143	0.3210
110	1	84.80	0.3090	0.3160
	2	84.80	0.3090	0.3160
CIE WI	3	85.00	0.3090	0.3150
86.58	4	84.80	0.3090	0.3160
	AVG	84.85	0.3090	0.3158

Appendix B (continued)

111	1	82.80	0.3130	0.3180
	2	82.90	0.3130	0.3180
CIE WI	3	83.10	0.3130	0.3180
77.64	4	82.60	0.3130	0.3180
	AVG	82.85	0.3130	0.3180
112	1	83.10	0.3120	0.3190
	2	83.00	0.3120	0.3190
CIE WI	3	83.20	0.3120	0.3190
76.99	4	83.10	0.3120	0.3190
	AVG	83.10	0.3120	0.3190
113	1	86.80	0.3130	0.3180
	2	86.20	0.3130	0.3180
CIE WI	3	86.80	0.3130	0.3180
81.44	4	86.80	0.3130	0.3180
	AVG	86.65	0.3130	0.3180
114	1	89.30	0.3150	0.3210
	2	89.20	0.3150	0.3210
CIE WI	3	89.30	0.3150	0.3210
77.73	4	89.40	0.3150	0.3200
	AVG	89.30	0.3150	0.3208
115	1	90.20	0.3120	0.3180
	2	89.90	0.3130	0.3180
CIE WI	3	90.00	0.3130	0.3180
84.95	4	89.90	0.3130	0.3180
	AVG	90.00	0.3128	0.3180
116	1	90.00	0.3120	0.3200
	2	90.30	0.3120	0.3200
CIE WI	3	90.00	0.3120	0.3200
82.27	4	90.00	0.3120	0.3200
	AVG	90.08	0.3120	0.3200
117	1	92.90	0.3140	0.3210
	2	92.60	0.3140	0.3210
CIE WI	3	92.80	0.3140	0.3210
81.72	4	93.00	0.3140	0.3210
	AVG	92.83	0.3140	0.3210
118	1	84.50	0.3110	0.3180
	2	84.50	0.3110	0.3180
CIE WI	3	84.60	0.3110	0.3180
80.89	4	84.40	0.3110	0.3180
	AVG	84.50	0.3110	0.3180

Appendix B (continued)

119	1	84.80	0.3120	0.3190
	2	84.60	0.3110	0.3190
CIE WI	3	84.80	0.3110	0.3190
78.99	4	84.60	0.3120	0.3190
	AVG	84.70	0.3115	0.3190
120	1	84.40	0.3110	0.3180
	2	84.20	0.3110	0.3180
CIE WI	3	83.80	0.3110	0.3180
79.86	4	83.50	0.3110	0.3190
	AVG	83.98	0.3110	0.3183
121	1	87.30	0.3120	0.3190
	2	87.20	0.3120	0.3190
CIE WI	3	87.30	0.3120	0.3190
81.19	4	87.40	0.3120	0.3190
	AVG	87.30	0.3120	0.3190
122	1	89.80	0.3120	0.3190
	2	89.50	0.3120	0.3190
CIE WI	3	89.90	0.3120	0.3190
83.57	4	89.50	0.3120	0.3190
	AVG	89.68	0.3120	0.3190
123	1	87.10	0.3150	0.3220
	2	86.90	0.3150	0.3220
CIE WI	3	87.10	0.3140	0.3220
73.60	4	87.10	0.3150	0.3220
	AVG	87.05	0.3148	0.3220
124	1	91.10	0.3130	0.3180
	2	91.00	0.3130	0.3180
CIE WI	3	90.90	0.3130	0.3180
85.77	4	90.90	0.3130	0.3180
	AVG	90.98	0.3130	0.3180
125	1	84.20	0.3130	0.3200
	2	84.20	0.3120	0.3200
CIE WI	3	84.40	0.3120	0.3200
76.07	4	84.30	0.3130	0.3200
	AVG	84.28	0.3125	0.3200
126	1	82.70	0.3130	0.3180
	2	82.90	0.3130	0.3180
CIE WI	3	82.80	0.3130	0.3180
77.57	4	82.70	0.3130	0.3180
	AVG	82.78	0.3130	0.3180

Appendix B (continued)

127	1	96.00	0.3100	0.3170
	2	95.90	0.3100	0.3170
CIE WI	3	95.90	0.3100	0.3170
95.03	4	95.40	0.3100	0.3160
	AVG	95.80	0.3100	0.3168
128	1	85.20	0.3130	0.3150
	2	85.40	0.3130	0.3180
CIE WI	3	85.50	0.3130	0.3180
81.02	4	85.40	0.3130	0.3190
	AVG	85.38	0.3130	0.3175

Appendix C

Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking

Appendix C

Minolta with Illuminant D₆₅ displaying L* vs. Visual Ranking

AVG L* = @ROUND(@SUM(D16..D19)/4,2)
 AVG a* = @ROUND(@SUM(E16..E19)/4,2)
 AVG b* = @ROUND(@SUM(F16..F19)/4,2)

GRADE CODE	SAMPLE	L* ILL D65 MINOLTA	a* ILL D65 MINOLTA	b* ILL D65 MINOLTA
=====	=====	=====	=====	=====
1	1	97.00	-0.70	1.70
	2	97.10	-0.70	1.70
	L*	97.10	-0.70	1.70
	97.05	97.00	-0.70	1.50
	AVG	97.05	-0.70	1.65
2	1	96.40	-0.40	1.20
	2	96.30	-0.50	1.10
	L*	96.40	-0.60	1.10
	96.33	96.20	-0.50	1.00
	AVG	96.33	-0.50	1.10
3	1	96.60	-1.10	4.20
	2	96.50	-1.10	4.30
	L*	96.60	-1.10	4.30
	96.58	96.60	-1.10	4.30
	AVG	96.58	-1.10	4.28
4	1	97.00	-1.20	3.60
	2	96.90	-1.20	3.70
	L*	96.90	-1.20	3.70
	96.93	96.90	-1.20	3.70
	AVG	96.93	-1.20	3.68
5	1	97.00	-0.40	3.20
	2	97.10	-0.70	3.10
	L*	96.70	-0.80	3.00
	96.95	97.00	-0.70	3.20
	AVG	96.95	-0.65	3.13
6	1	96.60	-0.60	3.00
	2	96.40	-0.70	2.80
	L*	96.00	-0.80	2.30
	96.40	96.60	-0.90	2.60
	AVG	96.40	-0.75	2.68

Appendix C (continued)

7		1	97.50	-1.00	2.20
		2	97.50	-0.90	2.10
	L*	3	97.40	-1.00	2.20
	97.45	4	97.40	-1.00	2.20
	AVG	97.45	-0.98	2.18	
8		1	97.20	-0.90	2.20
		2	97.20	-0.90	2.20
	L*	3	97.30	-1.00	2.40
	97.23	4	97.20	-0.80	2.20
	AVG	97.23	-0.90	2.25	
9		1	97.50	-0.90	1.80
		2	97.40	-0.90	1.70
	L*	3	97.40	-1.10	1.60
	97.38	4	97.20	-1.00	1.70
	AVG	97.38	-0.98	1.70	
10		1	96.90	-0.80	2.20
		2	97.00	-0.70	2.10
	L*	3	97.20	-0.80	2.00
	97.10	4	97.30	-0.90	2.00
	AVG	97.10	-0.80	2.08	
11		1	97.00	-0.70	3.10
		2	97.00	-0.80	3.10
	L*	3	97.10	-0.70	3.20
	97.00	4	96.90	-0.70	3.20
	AVG	97.00	-0.73	3.15	
12		1	96.80	-0.30	1.30
		2	96.70	-0.40	1.20
	L*	3	96.90	-0.40	1.10
	96.80	4	96.80	-0.30	1.30
	AVG	96.80	-0.35	1.23	
13		1	96.00	-0.70	5.30
		2	96.00	-0.50	5.30
	L*	3	96.10	-0.50	5.20
	96.05	4	96.10	-0.70	5.30
	AVG	96.05	-0.60	5.28	
14		1	95.90	-0.60	5.70
		2	95.90	-0.80	5.70
	L*	3	96.10	-0.70	5.80
	96.00	4	96.10	-0.70	5.60
	AVG	96.00	-0.70	5.70	

Appendix C (continued)

15		1	97.30	-0.90	2.10
		2	97.30	-0.80	2.20
	L*	3	97.30	-0.90	2.20
	97.30	4	97.30	-0.90	2.10
		AVG	97.30	-0.88	2.15
16		1	98.00	-0.90	1.60
		2	98.00	-0.80	1.60
	L*	3	98.00	-0.90	1.60
	98.00	4	98.00	-0.90	1.50
		AVG	98.00	-0.88	1.58
17		1	96.30	-1.20	4.30
		2	96.30	-1.30	4.30
	L*	3	96.30	-1.30	4.30
	96.28	4	96.20	-1.20	4.30
		AVG	96.28	-1.25	4.30
18		1	97.70	-0.70	1.10
		2	97.70	-0.80	1.20
	L*	3	97.70	-0.80	1.20
	97.70	4	97.70	-0.70	1.20
		AVG	97.70	-0.75	1.18
19		1	97.40	-0.70	1.80
		2	97.40	-0.70	1.80
	L*	3	97.20	-1.10	1.50
	97.35	4	97.40	-0.90	1.70
		AVG	97.35	-0.85	1.70
20		1	97.60	-1.30	4.90
		2	97.60	-1.30	4.90
	L*	3	97.50	-1.40	4.90
	97.55	4	97.50	-1.50	5.00
		AVG	97.55	-1.38	4.93
21		1	97.30	-1.20	5.40
		2	97.10	-1.10	5.10
	L*	3	96.80	-1.40	4.90
	96.98	4	96.70	-1.20	4.80
		AVG	96.98	-1.23	5.05
22		1	95.00	-0.30	2.40
		2	95.00	-0.30	2.40
	L*	3	95.00	-0.30	2.30
	95.00	4	95.00	-0.20	2.30
		AVG	95.00	-0.28	2.35

Appendix C (continued)

23		1	94.80	-0.50	2.50
		2	94.70	-0.30	2.60
	L*	3	94.80	-0.50	2.50
	94.78	4	94.80	-0.50	2.50
		AVG	94.78	-0.45	2.53
24		1	94.50	-0.50	2.50
		2	94.40	-0.40	2.40
	L*	3	94.50	-0.60	2.60
	94.45	4	94.40	-0.50	2.60
		AVG	94.45	-0.50	2.53
25		1	94.90	-0.10	2.30
		2	94.80	0.00	2.20
	L*	3	95.10	0.00	2.40
	94.93	4	94.90	0.00	2.40
		AVG	94.93	-0.03	2.33
26		1	94.70	-0.30	2.00
		2	94.70	-0.30	2.10
	L*	3	94.70	-0.30	2.10
	94.70	4	94.70	-0.30	2.00
		AVG	94.70	-0.30	2.05
27		1	95.20	-0.20	2.30
		2	95.10	-0.20	2.30
	L*	3	95.20	-0.30	2.10
	95.18	4	95.20	-0.30	2.30
		AVG	95.18	-0.25	2.25
28		1	94.90	-0.40	2.00
		2	94.80	-0.30	2.10
	L*	3	94.90	-0.30	2.30
	94.88	4	94.90	-0.30	2.20
		AVG	94.88	-0.33	2.15
29		1	94.80	-0.70	2.10
		2	94.80	-0.70	2.10
	L*	3	94.80	-0.70	2.00
	94.75	4	94.60	-0.60	2.10
		AVG	94.75	-0.68	2.08
30		1	94.70	-0.70	0.00
		2	94.70	-0.70	0.00
	L*	3	94.70	-0.60	0.10
	94.70	4	94.70	-0.60	0.10
		AVG	94.70	-0.65	0.05

Appendix C (continued)

31		1	94.50	0.30	-0.80
		2	94.50	0.10	-0.60
	L*	3	94.50	0.10	-0.60
	94.50	4	94.50	0.10	-0.60
		AVG	94.50	0.15	-0.65
32		1	94.80	-0.30	0.40
		2	94.80	-0.30	0.30
	L*	3	94.80	-0.20	0.30
	94.80	4	94.80	-0.30	0.30
		AVG	94.80	-0.28	0.33
33		1	94.70	-0.40	0.40
		2	94.60	-0.40	0.30
	L*	3	94.36	-0.40	0.30
	94.57	4	94.60	-0.30	0.30
		AVG	94.57	-0.38	0.33
34		1	95.20	-0.40	-0.50
		2	95.20	-0.60	0.50
	L*	3	95.30	-0.40	0.50
	95.25	4	95.30	-0.40	0.50
		AVG	95.25	-0.45	0.25
35		1	94.60	-0.50	0.20
		2	94.50	-0.40	0.20
	L*	3	94.60	-0.40	0.20
	94.58	4	94.60	-0.40	0.10
		AVG	94.58	-0.43	0.18
36		1	95.10	-0.10	0.70
		2	95.10	-0.20	0.80
	L*	3	95.10	-0.30	0.80
	95.10	4	95.10	-0.10	0.70
		AVG	95.10	-0.18	0.75
37		1	94.70	-0.50	0.40
		2	94.70	-0.50	0.30
	L*	3	94.70	-0.50	0.30
	94.75	4	94.90	-0.70	0.30
		AVG	94.75	-0.55	0.33
38		1	93.40	-0.90	0.00
		2	93.40	-0.90	0.00
	L*	3	93.40	-1.00	0.00
	93.40	4	93.40	-1.20	0.00
		AVG	93.40	-1.00	0.00

Appendix C (continued)

39		1	93.80	-1.00	0.40
		2	93.80	-1.10	0.50
	L*	3	93.70	-1.00	0.40
	93.78	4	93.80	-1.00	0.40
		AVG	93.78	-1.03	0.43
40		1	93.10	-0.90	0.10
		2	93.00	-0.80	0.00
	L*	3	93.00	-0.90	0.10
	93.05	4	93.10	-1.00	0.00
		AVG	93.05	-0.90	0.05
41		1	93.80	-1.00	0.10
		2	93.70	-1.00	0.00
	L*	3	93.90	-1.10	0.10
	93.83	4	93.90	-1.20	0.30
		AVG	93.83	-1.08	0.13
42		1	93.10	-0.70	1.30
		2	93.10	-0.70	1.40
	L*	3	93.20	-0.90	1.40
	93.13	4	93.10	-0.80	1.50
		AVG	93.13	-0.78	1.40
43		1	93.00	-1.20	1.90
		2	93.00	-1.30	1.90
	L*	3	93.00	-1.30	1.90
	93.00	4	93.00	-1.30	1.90
		AVG	93.00	-1.28	1.90
44		1	93.20	-0.90	1.60
		2	93.30	-0.80	1.60
	L*	3	93.40	-1.00	1.60
	93.30	4	93.30	-0.90	1.60
		AVG	93.30	-0.90	1.60
45		1	97.60	-0.50	0.40
		2	97.70	-0.40	0.40
	L*	3	97.60	-0.60	0.30
	97.60	4	97.50	-0.40	0.40
		AVG	97.60	-0.48	0.38
46		1	98.00	-0.50	0.70
		2	98.00	-0.60	0.70
	L*	3	97.50	-0.50	0.50
	97.85	4	97.90	-0.50	0.60
		AVG	97.85	-0.53	0.63

Appendix C (continued)

47		1	97.90	-0.50	0.80
		2	97.90	-0.50	0.90
	L*	3	97.50	-0.60	0.50
	97.68	4	97.40	-0.60	0.70
		AVG	97.68	-0.55	0.73
48		1	97.80	-0.30	0.90
		2	97.60	-0.30	0.90
	L*	3	97.80	-0.40	1.00
	97.78	4	97.90	-0.40	0.90
		AVG	97.78	-0.35	0.93
49		1	98.00	-0.60	0.60
		2	97.80	-0.70	0.80
	L*	3	98.00	-0.70	0.60
	97.93	4	97.90	-0.70	0.60
		AVG	97.93	-0.68	0.65
50		1	97.70	-0.60	1.10
		2	97.50	-0.50	1.10
	L*	3	97.00	-0.50	0.70
	97.35	4	97.20	-0.70	0.80
		AVG	97.35	-0.58	0.93
51		1	95.30	0.00	2.10
		2	95.30	0.10	2.10
	L*	3	95.30	0.00	2.10
	95.28	4	95.20	0.00	2.10
		AVG	95.28	0.03	2.10
52		1	95.50	-0.10	1.90
		2	95.40	-0.20	2.00
	L*	3	95.50	-0.10	8.00
	95.43	4	95.30	-0.10	2.00
		AVG	95.43	-0.13	3.48
53		1	95.00	-0.20	1.20
		2	95.00	-0.20	1.30
	L*	3	95.10	-0.30	1.10
	95.05	4	95.10	-0.30	1.30
		AVG	95.05	-0.25	1.23
54		1	96.40	-0.70	0.30
		2	96.40	-0.70	0.30
	L*	3	96.40	-0.70	0.30
	96.40	4	96.40	-0.50	0.10
		AVG	96.40	-0.65	0.25

Appendix C (continued)

55		1	96.50	-0.50	2.50
		2	96.50	-0.50	2.50
	L*	3	96.40	-0.60	2.40
	96.45	4	96.40	-0.50	2.40
		AVG	96.45	-0.53	2.45
56		1	95.40	0.20	2.60
		2	95.30	0.00	2.60
	L*	3	95.50	0.10	2.50
	95.38	4	95.30	0.30	2.30
		AVG	95.38	0.15	2.50
57		1	95.10	0.10	-2.10
		2	95.00	0.10	-2.00
	L*	3	95.10	0.00	-2.00
	95.05	4	95.00	0.10	-2.10
		AVG	95.05	0.08	-2.05
58		1	94.30	-0.10	-2.10
		2	94.20	0.00	-2.00
	L*	3	94.20	-0.10	-2.10
	94.23	4	94.20	-0.10	-2.10
		AVG	94.23	-0.08	-2.08
59		1	97.50	-1.00	1.60
		2	97.40	-1.10	1.70
	L*	3	97.50	-0.90	1.60
	97.50	4	97.60	-1.00	1.60
		AVG	97.50	-1.00	1.63
60		1	96.90	-0.90	2.70
		2	96.90	-1.00	2.90
	L*	3	97.00	-0.90	2.90
	96.93	4	96.90	-0.90	2.90
		AVG	96.93	-0.93	2.85
61		1	97.90	-1.10	1.10
		2	97.90	-1.00	1.00
	L*	3	97.60	-1.00	0.70
	97.85	4	98.00	-0.90	1.10
		AVG	97.85	-1.00	0.98
62		1	98.60	-0.90	0.70
		2	98.30	-0.90	0.50
	L*	3	97.40	-1.00	-0.10
	98.03	4	97.80	-0.80	0.00
		AVG	98.03	-0.90	0.28

Appendix C (continued)

63		1	96.10	-1.30	1.80
		2	96.10	-1.40	2.20
	L*	3	96.10	-1.30	2.10
	96.10	4	96.10	-1.30	2.10
		AVG	96.10	-1.33	2.05
64		1	92.80	-1.20	1.00
		2	92.80	-1.10	1.10
	L*	3	92.80	-1.20	1.10
	92.80	4	92.80	-1.20	1.10
		AVG	92.80	-1.18	1.08
65		1	96.90	-0.60	-0.30
		2	96.70	-0.60	-0.40
	L*	3	96.10	-0.50	-0.60
	96.58	4	96.60	-0.50	-0.50
		AVG	96.58	-0.55	-0.45
66		1	92.30	-0.30	0.00
		2	92.30	-0.40	0.00
	L*	3	92.30	-0.40	0.00
	92.30	4	92.30	-0.30	0.00
		AVG	92.30	-0.35	0.00
67		1	93.10	-0.90	2.10
		2	93.00	-1.00	2.00
	L*	3	93.10	-0.90	2.00
	93.05	4	93.00	-1.00	2.10
		AVG	93.05	-0.95	2.05
68		1	98.00	-1.00	1.10
		2	97.90	-1.00	1.30
	L*	3	97.80	-1.00	1.00
	97.90	4	97.90	-1.10	1.20
		AVG	97.90	-1.03	1.15
69		1	96.60	-1.40	3.70
		2	96.60	-1.40	3.90
	L*	3	96.60	-1.40	3.80
	96.55	4	96.40	-1.40	3.50
		AVG	96.55	-1.40	3.73
70		1	96.30	-1.30	4.90
		2	96.20	-1.30	5.00
	L*	3	96.30	-1.30	4.80
	96.28	4	96.30	-1.30	4.90
		AVG	96.28	-1.30	4.90

Appendix C (continued)

71		1	96.60	-0.70	1.90
		2	96.60	-0.70	2.00
	L*	3	96.70	-0.70	1.90
	96.65	4	96.70	-0.80	2.00
		AVG	96.65	-0.73	1.95
72		1	96.70	-0.80	1.70
		2	96.70	-0.70	1.90
	L*	3	96.70	-0.80	1.80
	96.70	4	96.70	-0.70	1.90
		AVG	96.70	-0.75	1.83
73		1	96.60	-1.40	4.40
		2	96.60	-1.40	4.40
	L*	3	96.50	-1.40	4.30
	96.55	4	96.50	-1.40	4.20
		AVG	96.55	-1.40	4.33
74		1	96.70	-1.60	5.40
		2	96.60	-1.70	5.40
	L*	3	96.70	-1.70	5.10
	96.60	4	96.40	-1.70	5.30
		AVG	96.60	-1.68	5.30
75		1	96.60	-0.90	1.10
		2	96.60	-0.90	1.10
	L*	3	96.00	-1.00	0.70
	96.45	4	96.60	-0.90	0.90
		AVG	96.45	-0.93	0.95
76		1	96.50	-0.80	1.80
		2	96.20	-0.80	1.90
	L*	3	96.50	-0.80	1.60
	96.30	4	96.00	-0.80	1.50
		AVG	96.30	-0.80	1.70
77		1	94.90	-0.40	2.50
		2	94.90	-0.40	2.50
	L*	3	94.90	-0.40	2.50
	94.88	4	94.80	-0.60	2.50
		AVG	94.88	-0.45	2.50
78		1	94.60	-0.50	2.20
		2	94.60	-0.50	2.20
	L*	3	94.60	-0.50	2.20
	94.58	4	94.50	-0.50	2.10
		AVG	94.58	-0.50	2.18

Appendix C (continued)

79		1	94.20	-0.60	2.50
		2	94.10	-0.70	2.40
	L*	3	93.80	-0.70	2.10
	94.10	4	94.30	-0.60	2.40
		AVG	94.10	-0.65	2.35
80		1	96.30	-0.10	1.70
		2	96.30	0.00	1.60
	L*	3	96.10	-0.20	1.40
	96.23	4	96.20	-0.10	1.60
		AVG	96.23	-0.10	1.58
81		1	94.30	-0.40	2.60
		2	94.40	-0.50	2.70
	L*	3	94.30	-0.30	2.70
	94.33	4	94.30	-0.50	2.70
		AVG	94.33	-0.43	2.68
82		1	92.30	-0.90	2.00
		2	92.10	-1.00	2.10
	L*	3	92.20	-0.90	1.90
	92.20	4	92.20	-0.90	2.10
		AVG	92.20	-0.93	2.03
83		1	95.30	-0.40	2.40
		2	95.40	-0.50	2.70
	L*	3	95.40	-0.40	2.50
	95.40	4	95.50	-0.50	2.70
		AVG	95.40	-0.45	2.58
84		1	93.70	0.30	0.80
		2	93.60	0.30	0.90
	L*	3	93.10	0.10	0.70
	93.53	4	93.70	0.20	1.10
		AVG	93.53	0.23	0.88
85		1	96.40	-0.80	3.20
		2	96.30	-0.80	3.10
	L*	3	96.40	-0.80	3.20
	96.40	4	96.50	-0.80	3.30
		AVG	96.40	-0.80	3.20
86		1	96.60	-1.00	3.40
		2	96.30	-0.90	3.30
	L*	3	96.30	-0.90	3.30
	96.35	4	96.20	-0.90	3.10
		AVG	96.35	-0.93	3.28

Appendix C (continued)

87		1	92.20	-0.50	0.40
		2	92.10	-0.60	0.30
	L*	3	92.00	-0.30	0.20
	92.10	4	92.10	-0.50	0.40
		AVG	92.10	-0.48	0.33
88		1	94.70	-1.00	2.20
		2	94.70	-1.10	2.20
	L*	3	94.60	-1.10	2.40
	94.68	4	94.70	-1.00	2.40
		AVG	94.68	-1.05	2.30
89		1	93.70	-0.90	2.50
		2	93.70	-0.90	2.40
	L*	3	93.50	-0.90	2.30
	93.63	4	93.60	-0.80	2.30
		AVG	93.63	-0.88	2.38
90		1	97.70	-0.20	1.00
		2	97.70	-0.20	0.90
	L*	3	97.50	-0.40	0.70
	97.65	4	97.70	-0.30	0.90
		AVG	97.65	-0.28	0.88
91		1	93.30	-0.80	1.20
		2	93.20	-0.70	1.10
	L*	3	93.10	-0.70	1.00
	93.25	4	93.40	-0.70	1.00
		AVG	93.25	-0.73	1.08
92		1	94.60	-0.60	1.20
		2	94.50	-0.70	1.30
	L*	3	94.10	-0.90	1.10
	94.43	4	94.50	-0.60	1.10
		AVG	94.43	-0.70	1.18
93		1	95.90	-1.00	4.40
		2	95.90	-0.90	4.40
	L*	3	95.90	-0.90	4.40
	95.90	4	95.90	-0.90	4.50
		AVG	95.90	-0.93	4.43
94		1	96.10	-0.50	1.60
		2	95.90	-0.30	1.50
	L*	3	95.80	-0.40	1.50
	95.98	4	96.10	-0.50	1.50
		AVG	95.98	-0.43	1.53

Appendix C (continued)

95		1	94.60	-1.00	0.50
		2	94.50	-0.80	0.60
	L*	3	94.40	-0.90	0.60
	94.53	4	94.60	-0.90	0.70
		AVG	94.53	-0.90	0.60
96		1	94.40	-0.10	1.40
		2	94.40	-0.10	1.30
	L*	3	94.50	-0.10	1.40
	94.45	4	94.50	-0.20	1.50
		AVG	94.45	-0.13	1.40
97		1	92.70	0.40	0.20
		2	92.70	0.30	0.40
	L*	3	92.70	0.40	0.40
	92.73	4	92.80	0.40	0.20
		AVG	92.73	0.38	0.30
98		1	94.00	-1.20	2.00
		2	94.20	-1.20	2.20
	L*	3	94.00	-1.10	2.10
	94.10	4	94.20	-1.10	2.20
		AVG	94.10	-1.15	2.13
99		1	96.00	-0.60	2.30
		2	96.10	-0.70	2.50
	L*	3	95.90	-0.60	2.50
	96.03	4	96.10	-0.70	2.50
		AVG	96.03	-0.65	2.45
100		1	97.30	0.00	1.50
		2	97.30	-0.20	1.40
	L*	3	97.10	-0.10	1.20
	97.28	4	97.40	0.00	1.50
		AVG	97.28	-0.08	1.40
101		1	95.80	-0.50	0.20
		2	95.70	-0.40	0.20
	L*	3	95.70	-0.40	0.10
	95.73	4	95.70	-0.40	0.10
		AVG	95.73	-0.43	0.15
102		1	93.30	-1.40	2.60
		2	93.30	-1.50	2.40
	L*	3	93.50	-1.40	2.50
	93.30	4	93.10	-1.40	2.60
		AVG	93.30	-1.43	2.53

Appendix C (continued)

103	1	95.00	-0.20	1.60
	2	94.80	-0.20	1.60
L*	3	94.90	-0.30	1.70
94.93	4	95.00	-0.20	1.70
	AVG	94.93	-0.23	1.65
104	1	95.30	-0.80	1.80
	2	95.20	-0.80	1.70
L*	3	95.00	-0.80	1.60
95.15	4	95.10	-0.80	1.70
	AVG	95.15	-0.80	1.70
105	1	95.50	-0.80	0.50
	2	95.10	-0.80	0.60
L*	3	95.40	-0.80	0.50
95.40	4	95.60	-0.70	0.40
	AVG	95.40	-0.78	0.50
106	1	94.50	-0.30	0.80
	2	94.60	-0.30	0.80
L*	3	94.60	-0.30	0.90
94.63	4	94.80	-0.20	0.70
	AVG	94.63	-0.28	0.80
107	1	96.00	-1.00	2.60
	2	95.80	-1.00	2.50
L*	3	96.00	-1.00	2.60
95.88	4	95.70	-0.90	2.50
	AVG	95.88	-0.98	2.55
108	1	95.30	-0.60	2.50
	2	95.30	-0.70	2.50
L*	3	95.20	-0.60	2.50
95.30	4	95.40	-0.60	2.60
	AVG	95.30	-0.63	2.53
109	1	94.30	-0.70	2.70
	2	94.20	-0.60	2.60
L*	3	94.30	-0.70	2.70
94.30	4	94.40	-0.70	2.70
	AVG	94.30	-0.68	2.68
110	1	93.50	-0.80	-0.10
	2	93.70	-1.00	0.00
L*	3	93.70	-0.90	0.00
93.65	4	93.70	-0.70	-0.10
	AVG	93.65	-0.85	-0.05

Appendix C (continued)

111		1	92.90	-0.10	1.40
		2	92.70	0.00	1.40
	L*	3	92.80	-0.10	1.40
	92.80	4	92.80	0.00	1.40
		AVG	92.80	-0.05	1.40
112		1	92.90	-0.70	1.40
		2	92.90	-0.80	1.40
	L*	3	92.60	-0.70	1.40
	92.85	4	93.00	-0.70	1.40
		AVG	92.85	-0.73	1.40
113		1	94.50	0.00	1.20
		2	94.30	-0.10	1.20
	L*	3	94.20	-0.10	1.10
	94.35	4	94.40	0.00	1.30
		AVG	94.35	-0.05	1.20
114		1	95.60	0.00	2.70
		2	95.60	0.00	2.70
	L*	3	95.40	0.10	2.60
	95.53	4	95.50	0.10	2.80
		AVG	95.53	0.05	2.70
115		1	95.80	0.00	1.20
		2	95.80	-0.10	1.20
	L*	3	95.70	-0.20	1.00
	95.80	4	95.90	0.00	1.30
		AVG	95.80	-0.08	1.18
116		1	95.80	-1.30	2.00
		2	95.70	-1.40	1.90
	L*	3	95.90	-1.30	1.90
	95.75	4	95.60	-1.40	2.00
		AVG	95.75	-1.35	1.95
117		1	96.90	-0.60	2.60
		2	96.80	-0.60	2.60
	L*	3	96.80	-0.50	2.50
	96.85	4	96.90	-0.60	2.60
		AVG	96.85	-0.58	2.58
118		1	93.50	-0.90	0.90
		2	93.60	-0.90	0.80
	L*	3	93.60	-0.90	0.90
	93.58	4	93.60	-0.80	0.90
		AVG	93.58	-0.88	0.88

Appendix C (continued)

119	1	93.50	-1.10	1.50
	2	93.50	-1.00	1.40
L*	3	93.60	-1.10	1.40
93.55	4	93.60	-1.20	1.50
	AVG	93.55	-1.10	1.45
120	1	93.40	-1.10	1.20
	2	93.40	-1.10	1.10
L*	3	93.10	-1.10	1.00
93.30	4	93.30	-1.00	1.00
	AVG	93.30	-1.08	1.08
121	1	94.70	-1.00	1.40
	2	94.80	-1.10	1.40
L*	3	94.70	-1.10	1.40
94.73	4	94.70	-0.90	1.30
	AVG	94.73	-1.03	1.38
122	1	95.70	-0.80	1.60
	2	95.60	-0.70	1.60
L*	3	95.80	-0.70	1.50
95.68	4	95.60	-0.60	1.60
	AVG	95.68	-0.70	1.58
123	1	94.70	-1.00	3.10
	2	94.50	-1.00	3.00
L*	3	94.70	-1.00	3.10
94.60	4	94.50	-1.00	3.00
	AVG	94.60	-1.00	3.05
124	1	96.40	-0.20	1.30
	2	96.30	-0.20	1.40
L*	3	96.20	-0.20	1.40
96.30	4	96.30	-0.10	1.30
	AVG	96.30	-0.18	1.35
125	1	93.40	-1.20	2.00
	2	93.40	-1.20	2.00
L*	3	93.50	-1.30	2.10
93.43	4	93.40	-1.20	2.10
	AVG	93.43	-1.23	2.05
126	1	92.80	0.20	1.20
	2	92.80	0.10	1.30
L*	3	92.80	0.20	0.90
92.78	4	92.70	0.20	1.20
	AVG	92.78	0.18	1.15

Appendix C (continued)

127	1	98.30	-0.90	0.40
	2	98.20	-0.70	0.40
L*	3	98.30	-0.90	0.40
98.25	4	98.20	-0.70	0.40
	AVG	98.25	-0.80	0.40
128	1	93.90	-0.30	1.40
	2	94.00	-0.30	1.40
L*	3	93.90	-0.30	1.40
93.90	4	93.80	-0.20	1.40
	AVG	93.90	-0.28	1.40

Appendix D

Minolta with Illum. D_{65} and calc. WI from Y, x, y vs. Visual Ranking

Appendix D

Minolta with Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

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CIE WI= @ROUND((D20)+(800*(0.3127-(E20)))+(
          (1700*(0.3290-(F20))),2)
AVG Y = @ROUND((@SUM(D16..D19)/4),2)
AVG x = @ROUND((@SUM(E16..E19)/4),4)
AVG y = @ROUND((@SUM(F16..F19)/4),4)

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GRADE CODE	SAMPLE	Y ILL D65 MINOLTA	x ILL D65 MINOLTA	y ILL D65 MINOLTA
=====	=====	=====	=====	=====
1	1	92.80	0.3150	0.3320
	2	92.90	0.3150	0.3320
CIE WI	3	93.10	0.3150	0.3320
86.10	4	92.70	0.3140	0.3320
	AVG	92.88	0.3148	0.3320
2	1	91.20	0.3140	0.3310
	2	91.10	0.3140	0.3310
CIE WI	3	91.20	0.3140	0.3310
86.61	4	90.70	0.3140	0.3310
	AVG	91.05	0.3140	0.3310
3	1	91.60	0.3180	0.3370
	2	91.50	0.3190	0.3370
CIE WI	3	91.80	0.3190	0.3370
73.20	4	91.80	0.3190	0.3370
	AVG	91.68	0.3188	0.3370
4	1	92.60	0.3170	0.3360
	2	92.40	0.3170	0.3360
CIE WI	3	92.60	0.3170	0.3360
77.21	4	92.60	0.3170	0.3360
	AVG	92.55	0.3170	0.3360
5	1	92.80	0.3170	0.3350
	2	93.00	0.3170	0.3350
CIE WI	3	92.00	0.3170	0.3350
78.96	4	92.60	0.3170	0.3350
	AVG	92.60	0.3170	0.3350
6	1	91.80	0.3170	0.3350
	2	91.20	0.3170	0.3340
CIE WI	3	90.40	0.3150	0.3330
79.95	4	91.90	0.3160	0.3340
	AVG	91.33	0.3163	0.3340

Appendix D (continued)

7	1	93.90	0.3150	0.3330
	2	93.90	0.3150	0.3330
CIE WI	3	93.80	0.3150	0.3330
85.19	4	93.70	0.3150	0.3330
	AVG	93.83	0.3150	0.3330
8	1	93.20	0.3150	0.3340
	2	93.20	0.3150	0.3340
CIE WI	3	93.40	0.3160	0.3340
83.01	4	93.20	0.3150	0.3330
	AVG	93.25	0.3153	0.3338
9	1	94.00	0.3150	0.3330
	2	93.90	0.3140	0.3320
CIE WI	3	93.60	0.3140	0.3320
86.31	4	93.30	0.3150	0.3330
	AVG	93.70	0.3145	0.3325
10	1	92.50	0.3150	0.3330
	2	92.70	0.3150	0.3330
CIE WI	3	93.10	0.3150	0.3330
84.29	4	93.40	0.3150	0.3330
	AVG	92.93	0.3150	0.3330
11	1	92.60	0.3170	0.3350
	2	92.60	0.3170	0.3350
CIE WI	3	92.90	0.3170	0.3350
79.01	4	92.50	0.3170	0.3350
	AVG	92.65	0.3170	0.3350
12	1	92.20	0.3140	0.3310
	2	91.90	0.3140	0.3310
CIE WI	3	92.50	0.3140	0.3310
87.76	4	92.20	0.3140	0.3310
	AVG	92.20	0.3140	0.3310
13	1	90.40	0.3210	0.3390
	2	90.40	0.3210	0.3390
CIE WI	3	90.60	0.3210	0.3390
66.84	4	90.50	0.3210	0.3390
	AVG	90.48	0.3210	0.3390
14	1	90.00	0.3220	0.3400
	2	90.10	0.3220	0.3400
CIE WI	3	90.40	0.3220	0.3400
64.09	4	90.40	0.3220	0.3400
	AVG	90.23	0.3220	0.3400

Appendix D (continued)

15	1	93.60	0.3150	0.3330
	2	93.60	0.3160	0.3330
CIE WI	3	93.60	0.3160	0.3330
84.56	4	93.60	0.3150	0.3330
	AVG	93.60	0.3155	0.3330
16	1	95.30	0.3140	0.3320
	2	95.30	0.3140	0.3320
CIE WI	3	95.20	0.3140	0.3320
89.14	4	95.30	0.3140	0.3320
	AVG	95.28	0.3140	0.3320
17	1	91.00	0.3190	0.3380
	2	91.00	0.3180	0.3370
CIE WI	3	91.10	0.3180	0.3380
72.07	4	90.90	0.3180	0.3370
	AVG	91.00	0.3183	0.3375
18	1	94.60	0.3140	0.3310
	2	94.50	0.3140	0.3310
CIE WI	3	94.50	0.3140	0.3310
90.06	4	94.40	0.3140	0.3310
	AVG	94.50	0.3140	0.3310
19	1	93.80	0.3150	0.3330
	2	93.80	0.3150	0.3330
CIE WI	3	93.30	0.3140	0.3320
86.00	4	93.60	0.3150	0.3320
	AVG	93.63	0.3148	0.3325
20	1	94.20	0.3190	0.3380
	2	94.20	0.3190	0.3380
CIE WI	3	93.90	0.3190	0.3380
73.25	4	94.10	0.3190	0.3390
	AVG	94.10	0.3190	0.3383
21	1	93.40	0.3210	0.3390
	2	92.90	0.3200	0.3390
CIE WI	3	92.20	0.3190	0.3390
70.26	4	91.90	0.3190	0.3380
	AVG	92.60	0.3198	0.3388
22	1	87.90	0.3170	0.3330
	2	87.90	0.3160	0.3330
CIE WI	3	88.00	0.3160	0.3330
78.27	4	88.00	0.3160	0.3330
	AVG	87.95	0.3163	0.3330

Appendix D (continued)

23	1	87.40	0.3170	0.3340
	2	87.20	0.3170	0.3340
	CIE WI	3	87.40	0.3170
	75.41	4	87.40	0.3170
	AVG	87.35	0.3170	0.3340
24	1	86.60	0.3160	0.3340
	2	86.40	0.3160	0.3340
	CIE WI	3	86.70	0.3160
	75.17	4	86.50	0.3170
	AVG	86.55	0.3163	0.3340
25	1	87.50	0.3170	0.3330
	2	87.40	0.3170	0.3330
	CIE WI	3	88.00	0.3170
	77.39	4	87.60	0.3170
	AVG	87.63	0.3170	0.3330
26	1	87.20	0.3160	0.3330
	2	87.20	0.3160	0.3330
	CIE WI	3	87.30	0.3160
	77.79	4	87.20	0.3160
	AVG	87.23	0.3160	0.3330
27	1	88.30	0.3160	0.3330
	2	88.20	0.3160	0.3330
	CIE WI	3	88.30	0.3160
	78.81	4	88.20	0.3160
	AVG	88.25	0.3160	0.3330
28	1	87.70	0.3160	0.3330
	2	87.30	0.3160	0.3330
	CIE WI	3	87.60	0.3160
	78.16	4	87.80	0.3160
	AVG	87.60	0.3160	0.3330
29	1	87.30	0.3160	0.3330
	2	87.40	0.3160	0.3330
	CIE WI	3	87.40	0.3150
	78.00	4	87.00	0.3160
	AVG	87.28	0.3158	0.3330
30	1	87.20	0.3120	0.3290
	2	87.10	0.3120	0.3290
	CIE WI	3	87.20	0.3120
	87.71	4	87.10	0.3120
	AVG	87.15	0.3120	0.3290

Appendix D (continued)

31	1	86.60	0.3120	0.3270
	2	86.60	0.3120	0.3270
CIE WI	3	86.60	0.3120	0.3270
90.56	4	86.60	0.3120	0.3270
	AVG	86.60	0.3120	0.3270
32	1	87.40	0.3130	0.3300
	2	87.30	0.3130	0.3300
CIE WI	3	87.40	0.3130	0.3300
85.41	4	87.30	0.3130	0.3300
	AVG	87.35	0.3130	0.3300
33	1	87.10	0.3130	0.3300
	2	87.00	0.3130	0.3300
CIE WI	3	86.90	0.3130	0.3300
85.06	4	87.00	0.3130	0.3300
	AVG	87.00	0.3130	0.3300
34	1	88.50	0.3110	0.3280
	2	88.50	0.3110	0.3280
CIE WI	3	88.50	0.3110	0.3280
91.56	4	88.50	0.3110	0.3280
	AVG	88.50	0.3110	0.3280
35	1	86.80	0.3120	0.3300
	2	86.80	0.3130	0.3300
CIE WI	3	86.90	0.3130	0.3290
86.14	4	86.80	0.3120	0.3290
	AVG	86.83	0.3125	0.3295
36	1	88.20	0.3140	0.3300
	2	88.20	0.3140	0.3300
CIE WI	3	88.10	0.3140	0.3300
85.41	4	88.10	0.3140	0.3300
	AVG	88.15	0.3140	0.3300
37	1	87.10	0.3130	0.3300
	2	87.10	0.3130	0.3300
CIE WI	3	87.10	0.3130	0.3300
85.42	4	87.50	0.3120	0.3300
	AVG	87.20	0.3128	0.3300
38	1	84.10	0.3110	0.3290
	2	84.10	0.3110	0.3290
CIE WI	3	84.10	0.3110	0.3290
84.95	4	84.10	0.3110	0.3300
	AVG	84.10	0.3110	0.3293

Appendix D (continued)

39	1	84.90	0.3120	0.3300
	2	85.00	0.3120	0.3310
CIE WI	3	84.90	0.3120	0.3300
83.30	4	85.00	0.3120	0.3300
	AVG	84.95	0.3120	0.3303
40	1	83.40	0.3110	0.3300
	2	83.40	0.3120	0.3290
CIE WI	3	83.30	0.3110	0.3300
83.65	4	83.40	0.3110	0.3290
	AVG	83.38	0.3113	0.3295
41	1	85.10	0.3110	0.3300
	2	84.70	0.3110	0.3290
CIE WI	3	85.30	0.3110	0.3300
85.08	4	85.20	0.3110	0.3300
	AVG	85.08	0.3110	0.3298
42	1	83.50	0.3140	0.3320
	2	83.50	0.3140	0.3320
CIE WI	3	83.80	0.3140	0.3320
77.46	4	83.60	0.3140	0.3320
	AVG	83.60	0.3140	0.3320
43	1	83.20	0.3140	0.3330
	2	83.30	0.3140	0.3330
CIE WI	3	83.20	0.3140	0.3330
75.39	4	83.20	0.3140	0.3330
	AVG	83.23	0.3140	0.3330
44	1	83.60	0.3140	0.3320
	2	84.00	0.3140	0.3320
CIE WI	3	84.10	0.3140	0.3320
77.66	4	83.50	0.3140	0.3320
	AVG	83.80	0.3140	0.3320
45	1	94.10	0.3130	0.3300
	2	94.40	0.3130	0.3300
CIE WI	3	94.30	0.3120	0.3300
92.45	4	94.10	0.3130	0.3300
	AVG	94.23	0.3128	0.3300
46	1	95.20	0.3130	0.3300
	2	95.20	0.3130	0.3300
CIE WI	3	94.00	0.3130	0.3300
92.91	4	95.00	0.3130	0.3300
	AVG	94.85	0.3130	0.3300

Appendix D (continued)

47	1	94.90	0.3140	0.3310
	2	94.90	0.3140	0.3310
CIE WI	3	93.90	0.3130	0.3300
91.16	4	93.70	0.3130	0.3300
	AVG	94.35	0.3135	0.3305
48	1	94.80	0.3140	0.3310
	2	94.10	0.3140	0.3310
CIE WI	3	94.80	0.3140	0.3310
90.24	4	95.00	0.3140	0.3310
	AVG	94.68	0.3140	0.3310
49	1	95.40	0.3130	0.3300
	2	94.70	0.3130	0.3310
CIE WI	3	95.20	0.3130	0.3300
92.63	4	95.00	0.3130	0.3300
	AVG	95.08	0.3130	0.3303
50	1	94.50	0.3140	0.3310
	2	94.00	0.3140	0.3310
CIE WI	3	92.70	0.3130	0.3300
89.69	4	93.30	0.3140	0.3310
	AVG	93.63	0.3138	0.3308
51	1	88.60	0.3170	0.3330
	2	88.60	0.3170	0.3330
CIE WI	3	88.60	0.3170	0.3330
78.45	4	88.30	0.3160	0.3330
	AVG	88.53	0.3168	0.3330
52	1	89.10	0.3160	0.3320
	2	88.90	0.3160	0.3330
CIE WI	3	89.20	0.3160	0.3320
80.70	4	88.60	0.3160	0.3320
	AVG	88.95	0.3160	0.3323
53	1	88.00	0.3150	0.3310
	2	87.90	0.3150	0.3310
CIE WI	3	88.10	0.3140	0.3310
82.92	4	88.00	0.3150	0.3310
	AVG	88.00	0.3148	0.3310
54	1	91.30	0.3120	0.3300
	2	91.30	0.3120	0.3300
CIE WI	3	91.30	0.3120	0.3300
90.48	4	91.20	0.3120	0.3290
	AVG	91.28	0.3120	0.3298

Appendix D (continued)

55	1	91.60	0.3160	0.3340
	2	91.40	0.3160	0.3340
CIE WI	3	91.30	0.3160	0.3340
80.26	4	91.30	0.3160	0.3340
	AVG	91.40	0.3160	0.3340
56	1	88.80	0.3180	0.3300
	2	88.60	0.3170	0.3340
CIE WI	3	89.00	0.3170	0.3330
79.12	4	88.60	0.3170	0.3330
	AVG	88.75	0.3173	0.3325
57	1	88.10	0.3090	0.3250
	2	88.00	0.3090	0.3250
CIE WI	3	88.00	0.3090	0.3250
97.79	4	88.00	0.3090	0.3250
	AVG	88.03	0.3090	0.3250
58	1	86.10	0.3090	0.3250
	2	85.90	0.3090	0.3250
CIE WI	3	86.00	0.3090	0.3250
95.76	4	86.00	0.3090	0.3250
	AVG	86.00	0.3090	0.3250
59	1	94.00	0.3140	0.3320
	2	93.80	0.3140	0.3320
CIE WI	3	94.00	0.3140	0.3320
87.84	4	94.10	0.3140	0.3320
	AVG	93.98	0.3140	0.3320
60	1	92.40	0.3160	0.3340
	2	92.40	0.3160	0.3350
CIE WI	3	92.80	0.3170	0.3350
79.60	4	92.40	0.3170	0.3350
	AVG	92.50	0.3165	0.3348
61	1	95.00	0.3130	0.3310
	2	94.90	0.3130	0.3310
CIE WI	3	94.20	0.3130	0.3310
91.19	4	95.20	0.3130	0.3310
	AVG	94.83	0.3130	0.3310
62	1	96.60	0.3130	0.3310
	2	96.00	0.3120	0.3300
CIE WI	3	93.70	0.3110	0.3290
94.48	4	94.80	0.3120	0.3290
	AVG	95.28	0.3120	0.3298

Appendix D (continued)

63	1	90.50	0.3140	0.3330
	2	90.60	0.3150	0.3340
CIE WI	3	90.50	0.3150	0.3340
80.69	4	90.50	0.3150	0.3340
	AVG	90.53	0.3148	0.3338
64	1	82.80	0.3130	0.3310
	2	82.70	0.3130	0.3320
CIE WI	3	82.70	0.3130	0.3320
77.75	4	82.80	0.3130	0.3320
	AVG	82.75	0.3130	0.3318
65	1	92.60	0.3110	0.3290
	2	92.10	0.3110	0.3280
CIE WI	3	90.50	0.3110	0.3280
94.25	4	91.60	0.3110	0.3280
	AVG	91.70	0.3110	0.3283
66	1	81.70	0.3120	0.3290
	2	81.60	0.3120	0.3290
CIE WI	3	81.60	0.3120	0.3290
82.19	4	81.60	0.3120	0.3290
	AVG	81.63	0.3120	0.3290
67	1	83.50	0.3150	0.3300
	2	83.30	0.3150	0.3330
CIE WI	3	83.40	0.3150	0.3330
75.93	4	83.30	0.3150	0.3330
	AVG	83.38	0.3150	0.3323
68	1	95.20	0.3130	0.3310
	2	94.90	0.3140	0.3320
CIE WI	3	94.60	0.3130	0.3310
90.22	4	95.10	0.3130	0.3320
	AVG	94.95	0.3133	0.3315
69	1	91.80	0.3170	0.3360
	2	91.80	0.3180	0.3370
CIE WI	3	91.80	0.3170	0.3370
75.25	4	91.30	0.3170	0.3360
	AVG	91.68	0.3173	0.3365
70	1	91.10	0.3200	0.3390
	2	90.80	0.3200	0.3390
CIE WI	3	91.00	0.3190	0.3390
68.51	4	90.90	0.3190	0.3390
	AVG	90.95	0.3195	0.3390

Appendix D (continued)

71	1	91.90	0.3150	0.3330
	2	91.70	0.3150	0.3330
CIE WI	3	92.00	0.3150	0.3330
83.24	4	91.90	0.3150	0.3330
	AVG	91.88	0.3150	0.3330
72	1	91.90	0.3150	0.3320
	2	92.00	0.3150	0.3330
CIE WI	3	92.10	0.3150	0.3330
83.70	4	92.00	0.3150	0.3330
	AVG	92.00	0.3150	0.3328
73	1	91.80	0.3180	0.3380
	2	91.60	0.3180	0.3380
CIE WI	3	91.40	0.3180	0.3380
72.38	4	91.50	0.3180	0.3370
	AVG	91.58	0.3180	0.3378
74	1	92.00	0.3200	0.3400
	2	91.70	0.3200	0.3400
CIE WI	3	92.10	0.3190	0.3390
67.74	4	91.30	0.3200	0.3400
	AVG	91.78	0.3198	0.3398
75	1	91.90	0.3130	0.3310
	2	91.70	0.3130	0.3310
CIE WI	3	90.40	0.3130	0.3310
87.76	4	91.60	0.3130	0.3310
	AVG	91.40	0.3130	0.3310
76	1	91.40	0.3150	0.3330
	2	90.80	0.3150	0.3330
CIE WI	3	91.40	0.3140	0.3320
83.56	4	90.20	0.3140	0.3320
	AVG	90.95	0.3145	0.3325
77	1	87.50	0.3170	0.3340
	2	87.50	0.3170	0.3340
CIE WI	3	87.60	0.3170	0.3340
75.56	4	87.40	0.3170	0.3340
	AVG	87.50	0.3170	0.3340
78	1	87.00	0.3160	0.3330
	2	86.80	0.3160	0.3330
CIE WI	3	87.00	0.3160	0.3330
77.41	4	86.60	0.3160	0.3330
	AVG	86.85	0.3160	0.3330

Appendix D (continued)

79	1	86.10	0.3160	0.3340
	2	85.80	0.3160	0.3340
CIE WI	3	85.10	0.3150	0.3330
75.19	4	86.30	0.3160	0.3340
	AVG	85.83	0.3158	0.3338
80	1	91.10	0.3150	0.3320
	2	91.00	0.3160	0.3320
CIE WI	3	90.50	0.3150	0.3320
83.62	4	90.60	0.3150	0.3320
	AVG	90.80	0.3153	0.3320
81	1	86.30	0.3170	0.3340
	2	86.40	0.3170	0.3340
CIE WI	3	86.20	0.3170	0.3340
74.34	4	86.20	0.3170	0.3340
	AVG	86.28	0.3170	0.3340
82	1	81.50	0.3150	0.3330
	2	81.20	0.3150	0.3330
CIE WI	3	81.30	0.3150	0.3330
72.71	4	81.40	0.3150	0.3330
	AVG	81.35	0.3150	0.3330
83	1	88.70	0.3160	0.3340
	2	88.90	0.3170	0.3340
CIE WI	3	88.90	0.3170	0.3340
77.10	4	89.00	0.3170	0.3340
	AVG	88.88	0.3168	0.3340
84	1	84.70	0.3150	0.3300
	2	84.70	0.3150	0.3300
CIE WI	3	83.60	0.3140	0.3300
81.05	4	84.70	0.3150	0.3300
	AVG	84.43	0.3148	0.3300
85	1	91.20	0.3170	0.3350
	2	90.90	0.3170	0.3350
CIE WI	3	91.40	0.3170	0.3350
77.59	4	91.40	0.3170	0.3350
	AVG	91.23	0.3170	0.3350
86	1	91.60	0.3170	0.3360
	2	91.00	0.3170	0.3350
CIE WI	3	91.00	0.3170	0.3350
76.95	4	90.80	0.3170	0.3350
	AVG	91.10	0.3170	0.3353

Appendix D (continued)

87	1	81.40	0.3130	0.3300
	2	81.10	0.3120	0.3300
CIE WI	3	80.90	0.3130	0.3290
79.71	4	81.20	0.3130	0.3300
	AVG	81.15	0.3128	0.3298
88	1	87.20	0.3150	0.3340
	2	87.10	0.3150	0.3340
CIE WI	3	86.90	0.3150	0.3340
76.50	4	87.10	0.3160	0.3340
	AVG	87.08	0.3153	0.3340
89	1	84.90	0.3160	0.3340
	2	84.70	0.3160	0.3340
CIE WI	3	84.40	0.3160	0.3340
73.51	4	84.60	0.3160	0.3340
	AVG	84.65	0.3160	0.3340
90	1	94.50	0.3140	0.3310
	2	94.40	0.3140	0.3300
CIE WI	3	94.00	0.3130	0.3300
90.90	4	94.40	0.3140	0.3310
	AVG	94.33	0.3138	0.3305
91	1	83.80	0.3140	0.3320
	2	83.70	0.3140	0.3310
CIE WI	3	83.40	0.3140	0.3310
78.78	4	84.00	0.3140	0.3310
	AVG	83.73	0.3140	0.3313
92	1	86.80	0.3140	0.3320
	2	86.80	0.3140	0.3320
CIE WI	3	85.80	0.3130	0.3310
81.40	4	86.70	0.3140	0.3310
	AVG	86.53	0.3138	0.3315
93	1	90.10	0.3190	0.3370
	2	90.10	0.3190	0.3380
CIE WI	3	90.00	0.3190	0.3370
70.56	4	90.00	0.3190	0.3380
	AVG	90.05	0.3190	0.3375
94	1	90.60	0.3150	0.3320
	2	90.10	0.3150	0.3320
CIE WI	3	89.90	0.3150	0.3320
83.34	4	90.50	0.3150	0.3320
	AVG	90.28	0.3150	0.3320

Appendix D (continued)

95	1	86.90	0.3120	0.3300
	2	86.70	0.3130	0.3310
CIE WI	3	86.50	0.3120	0.3310
83.83	4	86.80	0.3130	0.3310
	AVG	86.73	0.3125	0.3308
96	1	86.50	0.3150	0.3310
	2	86.50	0.3150	0.3310
CIE WI	3	86.60	0.3150	0.3310
80.80	4	86.60	0.3150	0.3320
	AVG	86.55	0.3150	0.3313
97	1	82.60	0.3140	0.3290
	2	82.60	0.3140	0.3290
CIE WI	3	82.50	0.3140	0.3290
81.56	4	82.70	0.3140	0.3290
	AVG	82.60	0.3140	0.3290
98	1	85.60	0.3150	0.3330
	2	86.00	0.3150	0.3340
CIE WI	3	85.50	0.3150	0.3330
76.26	4	85.90	0.3150	0.3340
	AVG	85.75	0.3150	0.3335
99	1	90.40	0.3160	0.3330
	2	90.50	0.3160	0.3340
CIE WI	3	90.10	0.3160	0.3340
79.58	4	90.50	0.3160	0.3340
	AVG	90.38	0.3160	0.3338
100	1	93.60	0.3150	0.3320
	2	93.40	0.3150	0.3310
CIE WI	3	92.90	0.3150	0.3310
87.68	4	93.80	0.3150	0.3310
	AVG	93.43	0.3150	0.3313
101	1	89.80	0.3120	0.3300
	2	89.50	0.3120	0.3290
CIE WI	3	89.50	0.3120	0.3290
89.65	4	89.60	0.3120	0.3290
	AVG	89.60	0.3120	0.3293
102	1	84.00	0.3150	0.3350
	2	83.90	0.3150	0.3340
CIE WI	3	84.30	0.3150	0.3340
72.76	4	83.60	0.3150	0.3350
	AVG	83.95	0.3150	0.3345

Appendix D (continued)

103	1	87.80	0.3150	0.3320
	2	87.50	0.3150	0.3320
CIE WI	3	87.70	0.3150	0.3320
80.76	4	87.80	0.3150	0.3320
	AVG	87.70	0.3150	0.3320
104	1	88.50	0.3150	0.3330
	2	88.40	0.3150	0.3320
CIE WI	3	88.00	0.3140	0.3320
80.96	4	88.10	0.3150	0.3320
	AVG	88.25	0.3148	0.3323
105	1	89.00	0.3130	0.3300
	2	88.20	0.3130	0.3300
CIE WI	3	88.90	0.3120	0.3300
87.05	4	89.20	0.3130	0.3300
	AVG	88.83	0.3128	0.3300
106	1	86.70	0.3140	0.3310
	2	86.90	0.3140	0.3310
CIE WI	3	86.90	0.3140	0.3310
82.90	4	87.50	0.3140	0.3300
	AVG	87.00	0.3140	0.3308
107	1	90.20	0.3160	0.3340
	2	89.70	0.3160	0.3340
CIE WI	3	90.20	0.3160	0.3340
78.76	4	89.50	0.3160	0.3340
	AVG	89.90	0.3160	0.3340
108	1	88.50	0.3160	0.3340
	2	88.60	0.3160	0.3340
CIE WI	3	88.30	0.3160	0.3340
77.41	4	88.80	0.3160	0.3340
	AVG	88.55	0.3160	0.3340
109	1	86.30	0.3160	0.3340
	2	86.00	0.3170	0.3340
CIE WI	3	86.20	0.3170	0.3340
74.45	4	86.40	0.3170	0.3340
	AVG	86.23	0.3168	0.3340
110	1	84.40	0.3110	0.3290
	2	84.80	0.3110	0.3290
CIE WI	3	84.70	0.3110	0.3290
86.01	4	84.70	0.3110	0.3290
	AVG	84.65	0.3110	0.3290

Appendix D (continued)

111	1	83.00	0.3150	0.3310
	2	82.50	0.3150	0.3310
CIE WI	3	82.80	0.3150	0.3310
77.54	4	82.80	0.3150	0.3310
	AVG	82.78	0.3150	0.3310
112	1	83.00	0.3140	0.3320
	2	82.90	0.3140	0.3320
CIE WI	3	82.30	0.3140	0.3320
76.71	4	83.20	0.3140	0.3320
	AVG	82.85	0.3140	0.3320
113	1	86.60	0.3150	0.3310
	2	86.10	0.3150	0.3310
CIE WI	3	86.10	0.3140	0.3310
81.25	4	86.50	0.3150	0.3310
	AVG	86.33	0.3148	0.3310
114	1	89.20	0.3180	0.3340
	2	89.20	0.3180	0.3340
CIE WI	3	88.90	0.3180	0.3340
76.34	4	89.00	0.3180	0.3340
	AVG	89.08	0.3180	0.3340
115	1	89.80	0.3150	0.3310
	2	89.70	0.3150	0.3310
CIE WI	3	89.50	0.3140	0.3310
84.67	4	90.00	0.3150	0.3310
	AVG	89.75	0.3148	0.3310
116	1	89.90	0.3140	0.3330
	2	89.50	0.3140	0.3330
CIE WI	3	90.00	0.3140	0.3330
81.81	4	89.20	0.3140	0.3330
	AVG	89.65	0.3140	0.3330
117	1	92.50	0.3160	0.3340
	2	92.30	0.3160	0.3340
CIE WI	3	92.30	0.3160	0.3340
81.24	4	92.40	0.3160	0.3340
	AVG	92.38	0.3160	0.3340
118	1	84.40	0.3130	0.3310
	2	84.50	0.3130	0.3310
CIE WI	3	84.50	0.3130	0.3310
80.84	4	84.50	0.3130	0.3310
	AVG	84.48	0.3130	0.3310

Appendix D (continued)

119	1	84.50	0.3140	0.3320
	2	84.40	0.3140	0.3320
CIE WI	3	84.60	0.3140	0.3320
78.36	4	84.50	0.3140	0.3320
	AVG	84.50	0.3140	0.3320
120	1	84.20	0.3130	0.3320
	2	84.10	0.3130	0.3320
CIE WI	3	83.50	0.3130	0.3310
79.41	4	83.80	0.3130	0.3310
	AVG	83.90	0.3130	0.3315
121	1	87.20	0.3140	0.3320
	2	87.30	0.3140	0.3320
CIE WI	3	87.10	0.3140	0.3320
81.06	4	87.20	0.3140	0.3320
	AVG	87.20	0.3140	0.3320
122	1	89.60	0.3140	0.3320
	2	89.20	0.3150	0.3320
CIE WI	3	89.70	0.3140	0.3320
82.91	4	89.30	0.3150	0.3320
	AVG	89.45	0.3145	0.3320
123	1	87.10	0.3170	0.3350
	2	86.80	0.3170	0.3350
CIE WI	3	87.10	0.3170	0.3350
73.29	4	86.70	0.3170	0.3350
	AVG	86.93	0.3170	0.3350
124	1	91.20	0.3150	0.3310
	2	91.00	0.3150	0.3320
CIE WI	3	90.80	0.3150	0.3310
85.23	4	90.90	0.3150	0.3310
	AVG	90.98	0.3150	0.3313
125	1	84.10	0.3150	0.3330
	2	84.10	0.3150	0.3330
CIE WI	3	84.30	0.3150	0.3340
74.66	4	84.10	0.3150	0.3340
	AVG	84.15	0.3150	0.3335
126	1	82.70	0.3150	0.3310
	2	82.70	0.3150	0.3310
CIE WI	3	82.70	0.3150	0.3300
77.80	4	82.70	0.3150	0.3310
	AVG	82.70	0.3150	0.3308

Appendix D (continued)

127	1	95.90	0.3120	0.3300
	2	95.70	0.3120	0.3300
CIE WI	3	95.90	0.3120	0.3300
94.69	4	95.80	0.3120	0.3300
	AVG	95.83	0.3120	0.3300
128	1	85.20	0.3150	0.3320
	2	85.40	0.3150	0.3320
CIE WI	3	85.30	0.3150	0.3320
78.31	4	85.10	0.3150	0.3320
	AVG	85.25	0.3150	0.3320

Appendix E

X-Rite 948 with Illuminant C displaying L* vs. Visual Ranking

Appendix E

X-Rite 948 with Illuminant C displaying L* vs. Visual Ranking

AVG L* = @ROUND(@SUM(D16..D19)/4,2)
 AVG a* = @ROUND(@SUM(E16..E19)/4,2)
 AVG b* = @ROUND(@SUM(F16..F19)/4,2)

GRADE CODE	SAMPLE	L* ILL C X-RITE	a* ILL C X-RITE	b* ILL C X-RITE
=====	=====	=====	=====	=====
1	1	97.28	1.26	-0.42
	2	97.24	1.19	-0.51
	L* 3	97.28	1.25	-0.60
	97.22 4	97.09	1.24	-0.86
	AVG	97.22	1.24	-0.60
2	1	96.70	1.83	-2.19
	2	96.75	1.82	-1.96
	L* 3	96.72	1.67	-2.11
	96.72 4	96.71	1.71	-1.96
	AVG	96.72	1.76	-2.06
3	1	96.51	-0.74	6.04
	2	96.41	-0.68	6.06
	L* 3	96.51	-0.79	6.16
	96.44 4	96.32	-0.77	5.93
	AVG	96.44	-0.75	6.05
4	1	96.72	-0.68	5.00
	2	96.73	-0.75	5.01
	L* 3	96.68	-0.78	5.00
	96.73 4	96.80	-0.77	5.13
	AVG	96.73	-0.75	5.04
5	1	96.99	0.57	2.62
	2	97.10	0.53	2.69
	L* 3	96.81	0.38	2.37
	97.00 4	97.10	0.53	2.75
	AVG	97.00	0.50	2.61
6	1	96.51	0.81	1.44
	2	96.04	0.94	1.02
	L* 3	95.87	0.70	0.72
	96.30 4	96.79	0.72	1.57
	AVG	96.30	0.79	1.19

Appendix E (continued)

7		1	97.62	0.48	1.20
		2	97.69	0.38	1.42
	L*	3	97.54	0.51	1.08
	97.62	4	97.62	0.46	1.00
		AVG	97.62	0.46	1.18
8		1	97.50	0.45	1.42
		2	97.45	0.47	1.39
	L*	3	97.48	0.39	0.99
	97.50	4	97.55	0.32	1.62
		AVG	97.50	0.41	1.36
9		1	97.63	0.34	1.29
		2	97.61	0.34	1.26
	L*	3	97.55	0.14	1.06
	97.60	4	97.60	0.23	1.22
		AVG	97.60	0.26	1.21
10		1	97.39	0.47	1.45
		2	97.35	0.54	1.35
	L*	3	97.39	0.36	1.29
	97.38	4	97.40	0.34	1.38
		AVG	97.38	0.43	1.37
11		1	97.01	0.79	1.62
		2	96.93	0.69	1.51
	L*	3	96.15	0.85	0.71
	96.74	4	96.88	0.74	1.53
		AVG	96.74	0.77	1.34
12		1	97.06	0.82	0.73
		2	96.99	0.83	0.85
	L*	3	97.04	0.59	0.74
	96.97	4	96.79	0.78	0.40
		AVG	96.97	0.76	0.68
13		1	96.05	0.34	4.95
		2	95.81	0.28	4.89
	L*	3	95.97	0.16	5.00
	95.87	4	95.63	0.21	4.52
		AVG	95.87	0.25	4.84
14		1	96.14	0.50	5.04
		2	96.15	0.45	5.01
	L*	3	95.99	0.35	4.71
	96.09	4	96.09	0.38	4.85
		AVG	96.09	0.42	4.90

Appendix E (continued)

15		1	97.33	0.39	1.73
		2	97.37	0.39	1.59
	L*	3	96.90	0.47	1.33
	97.15	4	97.00	0.50	1.27
		AVG	97.15	0.44	1.48
16		1	98.09	0.04	1.68
		2	98.08	0.04	1.71
	L*	3	98.07	-0.02	1.66
	98.05	4	97.94	-0.01	1.54
		AVG	98.05	0.01	1.65
17		1	96.14	-0.92	6.18
		2	96.11	-0.97	6.14
	L*	3	96.03	-1.06	6.04
	96.02	4	95.80	-0.96	5.86
		AVG	96.02	-0.98	6.06
18		1	97.71	0.06	1.77
		2	97.74	0.01	1.80
	L*	3	97.76	-0.01	1.92
	97.73	4	97.72	0.01	1.82
		AVG	97.73	0.02	1.83
19		1	97.87	0.26	1.76
		2	97.49	0.25	1.28
	L*	3	97.61	0.15	1.33
	97.63	4	97.53	0.27	1.33
		AVG	97.63	0.23	1.43
20		1	97.33	-1.04	6.81
		2	97.43	-1.09	6.86
	L*	3	97.38	-1.14	6.75
	97.38	4	97.38	-1.10	6.86
		AVG	97.38	-1.09	6.82
21		1	97.07	-0.82	7.34
		2	96.80	-0.91	7.08
	L*	3	96.92	-1.00	7.23
	96.88	4	96.74	-1.11	6.96
		AVG	96.88	-0.96	7.15
22		1	95.13	1.03	1.09
		2	95.11	1.03	1.05
	L*	3	95.24	0.95	1.08
	95.14	4	95.06	1.09	0.93
		AVG	95.14	1.03	1.04

Appendix E (continued)

23		1	94.86	1.34	0.57
		2	94.91	1.25	0.75
	L*	3	94.94	1.22	0.68
	94.86	4	94.74	1.28	0.64
		AVG	94.86	1.27	0.66
24		1	94.57	1.04	0.84
		2	94.57	0.89	1.16
	L*	3	94.60	0.88	0.85
	94.58	4	94.59	0.86	1.27
		AVG	94.58	0.92	1.03
25		1	95.10	1.55	0.36
		2	94.98	1.60	0.29
	L*	3	95.14	1.35	0.38
	95.06	4	95.01	1.63	0.14
		AVG	95.06	1.53	0.29
26		1	94.75	1.05	0.66
		2	94.87	0.97	0.72
	L*	3	94.82	0.99	0.76
	94.81	4	94.78	1.03	0.77
		AVG	94.81	1.01	0.73
27		1	95.23	1.05	0.96
		2	95.19	1.12	0.94
	L*	3	95.19	1.01	0.78
	95.18	4	95.12	1.21	0.63
		AVG	95.18	1.10	0.83
28		1	95.03	1.26	0.36
		2	95.11	1.25	0.40
	L*	3	95.03	1.17	0.29
	95.04	4	94.97	1.21	0.19
		AVG	95.04	1.22	0.31
29		1	94.82	0.78	0.87
		2	94.84	0.81	0.82
	L*	3	94.81	0.74	0.86
	94.80	4	94.72	0.82	0.71
		AVG	94.80	0.79	0.82
30		1	94.85	0.69	-0.96
		2	94.96	0.65	-1.05
	L*	3	94.77	0.82	-1.37
	94.87	4	94.90	0.75	-1.18
		AVG	94.87	0.73	-1.14

Appendix E (continued)

31		1	94.48	1.19	-1.50
		2	94.69	1.25	-2.01
	L*	3	94.57	1.34	-1.84
	94.58	4	94.56	1.23	-1.74
		AVG	94.58	1.25	-1.77
32		1	94.87	0.79	-0.55
		2	94.92	0.79	-0.71
	L*	3	95.03	0.71	-0.70
	94.95	4	94.98	0.76	-0.66
		AVG	94.95	0.76	-0.66
33		1	94.90	0.96	-0.92
		2	94.79	0.92	-0.89
	L*	3	94.87	0.97	-0.93
	94.86	4	94.88	1.02	-1.06
		AVG	94.86	0.97	-0.95
34		1	95.36	0.52	-1.12
		2	95.39	0.47	-1.01
	L*	3	95.39	0.46	-0.99
	95.39	4	95.40	0.44	-0.91
		AVG	95.39	0.47	-1.01
35		1	94.80	0.69	-0.85
		2	94.74	0.66	-0.85
	L*	3	94.78	0.60	-0.78
	94.78	4	94.79	0.65	-0.82
		AVG	94.78	0.65	-0.83
36		1	95.27	1.04	-0.55
		2	95.39	0.93	-0.29
	L*	3	95.33	0.95	-0.55
	95.31	4	95.26	1.02	-0.47
		AVG	95.31	0.99	-0.47
37		1	95.10	1.04	-1.21
		2	95.10	1.04	-1.28
	L*	3	95.15	0.98	-1.27
	95.11	4	95.08	1.00	-1.18
		AVG	95.11	1.02	-1.24
38		1	93.54	-0.34	1.16
		2	93.58	-0.35	1.34
	L*	3	93.61	-0.41	1.27
	93.59	4	93.63	-0.40	1.23
		AVG	93.59	-0.38	1.25

Appendix E (continued)

39		1	93.91	-0.17	1.14
		2	93.89	-0.15	1.27
	L*	3	93.88	-0.17	1.16
	93.87	4	93.80	-0.12	1.21
		AVG	93.87	-0.15	1.20
40		1	93.40	-0.27	1.11
		2	93.45	-0.25	1.17
	L*	3	93.36	-0.28	1.16
	93.38	4	93.30	-0.24	1.18
		AVG	93.38	-0.26	1.16
41		1	94.14	-0.25	0.61
		2	94.14	-0.22	0.69
	L*	3	94.13	-0.25	0.75
	94.13	4	94.10	-0.22	0.65
		AVG	94.13	-0.24	0.68
42		1	93.26	0.19	1.40
		2	93.24	0.31	1.45
	L*	3	93.22	0.22	1.28
	93.23	4	93.19	0.40	1.20
		AVG	93.23	0.28	1.33
43		1	93.17	0.00	1.22
		2	93.12	0.02	1.27
	L*	3	93.19	-0.13	1.14
	93.15	4	93.11	0.08	1.11
		AVG	93.15	-0.01	1.19
44		1	93.39	0.24	1.58
		2	93.47	0.10	1.55
	L*	3	93.46	0.10	1.36
	93.43	4	93.41	0.09	1.50
		AVG	93.43	0.13	1.50
45		1	97.80	1.12	-1.33
		2	97.93	1.07	-1.27
	L*	3	97.82	0.94	-1.62
	97.80	4	97.65	1.11	-1.71
		AVG	97.80	1.06	-1.48
46		1	98.07	1.34	-1.67
		2	98.15	1.29	-1.68
	L*	3	97.67	1.25	-2.22
	97.95	4	97.92	1.24	-1.97
		AVG	97.95	1.28	-1.89

Appendix E (continued)

47		1	97.96	0.54	0.90
		2	97.99	0.59	0.82
	L*	3	97.65	0.35	0.60
	97.84	4	97.74	0.53	0.70
		AVG	97.84	0.50	0.76
48		1	98.03	0.86	0.27
		2	97.97	0.89	0.21
	L*	3	97.87	0.75	0.13
	97.92	4	97.79	0.82	0.01
		AVG	97.92	0.83	0.16
49		1	98.11	0.39	0.44
		2	98.03	0.38	0.53
	L*	3	98.14	0.17	0.42
	98.11	4	98.14	0.36	0.50
		AVG	98.11	0.33	0.47
50		1	97.88	1.42	-1.74
		2	97.58	1.60	-1.68
	L*	3	97.29	1.52	-2.05
	97.60	4	97.64	1.49	-1.46
		AVG	97.60	1.51	-1.73
51		1	95.44	1.27	1.35
		2	95.42	1.33	1.29
	L*	3	95.53	1.10	1.57
	95.47	4	95.47	1.35	1.18
		AVG	95.47	1.26	1.35
52		1	95.75	0.99	1.39
		2	95.73	1.13	1.18
	L*	3	95.54	0.90	1.08
	95.68	4	95.70	1.00	1.33
		AVG	95.68	1.01	1.25
53		1	95.04	1.58	-0.76
		2	94.99	1.50	-0.67
	L*	3	94.98	1.52	-0.63
	94.99	4	94.94	1.55	-0.72
		AVG	94.99	1.54	-0.70
54		1	96.25	-0.62	2.27
		2	96.22	-0.63	2.33
	L*	3	96.24	-0.62	2.24
	96.23	4	96.19	-0.57	2.21
		AVG	96.23	-0.61	2.26

Appendix E (continued)

55		1	96.63	0.62	1.94
		2	96.58	0.53	2.24
	L*	3	96.47	0.45	1.83
	96.58	4	96.64	0.55	2.03
		AVG	96.58	0.54	2.01
56		1	95.47	1.62	1.09
		2	95.42	1.62	1.22
	L*	3	95.44	1.44	1.15
	95.44	4	95.42	1.54	1.19
		AVG	95.44	1.56	1.16
57		1	94.96	0.14	-0.01
		2	95.00	0.13	0.06
	L*	3	94.96	0.16	0.00
	94.97	4	94.96	0.16	-0.05
		AVG	94.97	0.15	0.00
58		1	94.17	-0.20	-0.11
		2	94.23	-0.26	0.02
	L*	3	94.10	-0.21	-0.08
	94.17	4	94.16	-0.22	-0.03
		AVG	94.17	-0.22	-0.05
59		1	97.51	0.22	1.65
		2	97.56	0.22	1.68
	L*	3	97.51	0.18	1.44
	97.52	4	97.48	0.27	1.54
		AVG	97.52	0.22	1.58
60		1	97.08	0.89	0.97
		2	97.04	0.86	1.05
	L*	3	96.81	0.93	0.78
	96.95	4	96.85	0.84	0.50
		AVG	96.95	0.88	0.83
61		1	97.98	-0.76	3.04
		2	97.79	-0.74	3.01
	L*	3	97.39	-0.79	2.38
	97.63	4	97.37	-0.76	2.39
		AVG	97.63	-0.76	2.71
62		1	98.42	1.53	-2.68
		2	98.31	1.55	-2.76
	L*	3	97.48	1.63	-3.70
	97.90	4	97.38	1.63	-3.70
		AVG	97.90	1.59	-3.21

Appendix E (continued)

63		1	96.21	0.63	-0.78
		2	96.18	0.65	-0.79
	L*	3	96.07	0.49	-1.00
	96.15	4	96.12	0.61	-0.70
		AVG	96.15	0.60	-0.82
64		1	92.82	0.06	0.80
		2	92.87	-0.02	0.96
	L*	3	92.80	0.05	0.85
	92.83	4	92.84	0.04	0.88
		AVG	92.83	0.03	0.87
65		1	96.93	1.27	-2.43
		2	96.94	1.25	-2.49
	L*	3	96.68	1.26	-2.68
	96.89	4	97.00	1.23	-2.52
		AVG	96.89	1.25	-2.53
66		1	92.29	-0.44	2.11
		2	92.31	-0.42	2.20
	L*	3	92.23	-0.45	2.13
	92.27	4	92.26	-0.38	2.14
		AVG	92.27	-0.42	2.15
67		1	93.17	0.13	1.93
		2	93.20	0.11	1.94
	L*	3	93.22	0.18	1.83
	93.19	4	93.15	0.24	1.71
		AVG	93.19	0.17	1.85
68		1	97.56	1.55	-2.91
		2	97.62	1.42	-2.69
	L*	3	96.86	1.60	-3.29
	97.35	4	97.35	1.54	-3.06
		AVG	97.35	1.53	-2.99
69		1	96.54	-1.08	5.73
		2	96.52	-1.07	5.69
	L*	3	96.43	-1.07	5.53
	96.47	4	96.38	-1.05	5.60
		AVG	96.47	-1.07	5.64
70		1	96.39	-0.38	5.11
		2	96.11	-0.35	4.88
	L*	3	96.08	-0.43	4.68
	96.21	4	96.27	-0.29	5.05
		AVG	96.21	-0.36	4.93

Appendix E (continued)

71	1	96.86	1.37	-1.12
	2	96.83	1.37	-1.03
	L*	3	96.61	1.31
	96.76	4	96.74	1.44
	AVG	96.76	1.37	-1.21
72	1	96.92	1.55	-1.47
	2	96.82	1.56	-1.43
	L*	3	96.94	1.30
	96.86	4	96.77	1.46
	AVG	96.86	1.47	-1.55
73	1	96.47	-0.93	5.99
	2	96.41	-0.93	6.17
	L*	3	95.75	-0.90
	96.29	4	96.51	-0.87
	AVG	96.29	-0.91	5.83
74	1	96.61	-1.19	7.03
	2	96.76	-1.20	6.96
	L*	3	96.38	-1.28
	96.59	4	96.59	-1.15
	AVG	96.59	-1.21	6.86
75	1	96.59	-0.48	2.88
	2	96.61	-0.50	2.96
	L*	3	96.22	-0.62
	96.42	4	96.25	-0.46
	AVG	96.42	-0.52	2.72
76	1	96.52	-0.44	3.69
	2	96.45	-0.43	3.62
	L*	3	96.08	-0.56
	96.34	4	96.31	-0.46
	AVG	96.34	-0.47	3.49
77	1	94.73	0.28	3.47
	2	94.71	0.29	3.53
	L*	3	94.78	0.12
	94.72	4	94.65	0.28
	AVG	94.72	0.24	3.42
78	1	94.47	-0.07	3.59
	2	94.47	-0.05	3.58
	L*	3	94.39	-0.11
	94.43	4	94.39	-0.06
	AVG	94.43	-0.07	3.53

Appendix E (continued)

79		1	94.35	-0.01	3.12
		2	94.37	0.03	3.13
	L*	3	94.18	-0.03	2.97
	94.29	4	94.26	0.07	3.02
		AVG	94.29	0.02	3.06
80		1	96.38	1.02	1.26
		2	96.44	0.96	1.35
	L*	3	96.49	0.84	1.22
	96.43	4	96.40	1.01	1.35
		AVG	96.43	0.96	1.30
81		1	94.33	1.11	1.17
		2	94.36	1.05	1.18
	L*	3	94.33	0.87	1.28
	94.33	4	94.29	1.12	1.24
		AVG	94.33	1.04	1.22
82		1	92.07	-0.92	3.98
		2	92.20	-1.02	4.01
	L*	3	92.23	-0.96	3.95
	92.19	4	92.25	-0.90	4.12
		AVG	92.19	-0.95	4.02
83		1	95.28	0.86	1.44
		2	95.26	0.94	1.34
	L*	3	95.30	0.88	1.30
	95.23	4	95.09	0.90	1.44
		AVG	95.23	0.90	1.38
84		1	93.56	1.50	0.13
		2	93.53	1.48	0.19
	L*	3	93.59	1.46	0.06
	93.55	4	93.53	1.52	0.19
		AVG	93.55	1.49	0.14
85		1	96.52	1.17	0.49
		2	96.55	1.14	0.45
	L*	3	96.15	0.99	-0.03
	96.45	4	96.59	1.10	0.54
		AVG	96.45	1.10	0.36
86		1	96.28	-0.70	5.31
		2	96.32	-0.72	5.34
	L*	3	95.80	-0.81	4.72
	96.08	4	95.91	-0.74	5.08
		AVG	96.08	-0.74	5.11

Appendix E (continued)

87		1	92.13	-0.63	2.61
		2	92.15	-0.57	2.58
	L*	3	92.17	-0.59	2.58
	92.16	4	92.18	-0.58	2.70
		AVG	92.16	-0.59	2.62
88		1	94.72	0.77	0.42
		2	94.75	0.76	0.41
	L*	3	94.77	0.74	0.33
	94.74	4	94.71	0.78	0.40
		AVG	94.74	0.76	0.39
89		1	93.69	0.63	1.04
		2	93.73	0.60	0.99
	L*	3	93.68	0.53	0.92
	93.68	4	93.62	0.65	1.00
		AVG	93.68	0.60	0.99
90		1	97.68	1.62	-1.32
		2	97.75	1.56	-1.35
	L*	3	97.68	1.54	-1.56
	97.73	4	97.80	1.59	-1.34
		AVG	97.73	1.58	-1.39
91		1	93.28	0.46	0.68
		2	93.31	0.53	0.48
	L*	3	93.29	0.35	0.52
	93.29	4	93.29	0.47	0.60
		AVG	93.29	0.45	0.57
92		1	94.39	0.47	0.69
		2	94.39	0.42	0.70
	L*	3	94.26	0.40	0.54
	94.33	4	94.28	0.44	0.62
		AVG	94.33	0.43	0.64
93		1	95.76	-0.15	4.84
		2	95.67	-0.05	4.59
	L*	3	95.67	-0.19	4.47
	95.72	4	95.76	-0.08	4.69
		AVG	95.72	-0.12	4.65
94		1	96.17	1.77	-1.96
		2	96.15	1.81	-1.95
	L*	3	96.15	1.68	-2.04
	96.15	4	96.14	1.75	-2.03
		AVG	96.15	1.75	-2.00

Appendix E (continued)

95		1	94.55	0.75	-1.20
		2	94.53	0.84	-1.20
	L*	3	94.58	0.73	-1.18
	94.54	4	94.49	0.74	-1.05
		AVG	94.54	0.77	-1.16
96		1	94.41	1.41	0.01
		2	94.44	1.48	-0.09
	L*	3	94.57	1.35	-0.16
	94.46	4	94.42	1.39	0.06
		AVG	94.46	1.41	-0.05
97		1	92.62	0.65	1.48
		2	92.66	0.72	1.41
	L*	3	92.69	0.64	1.35
	92.66	4	92.65	0.70	1.39
		AVG	92.66	0.68	1.41
98		1	94.08	-0.37	2.32
		2	94.10	-0.30	2.33
	L*	3	94.16	-0.37	2.32
	94.10	4	94.05	-0.31	2.31
		AVG	94.10	-0.34	2.32
99		1	95.89	0.72	1.39
		2	95.92	0.70	1.36
	L*	3	95.68	0.66	1.14
	95.79	4	95.68	0.71	1.06
		AVG	95.79	0.70	1.24
100		1	97.10	1.71	-0.88
		2	97.16	1.76	-0.80
	L*	3	96.92	1.66	-1.12
	97.05	4	97.03	1.69	-1.02
		AVG	97.05	1.71	-0.96
101		1	95.80	0.93	-0.65
		2	95.78	0.89	-0.63
	L*	3	95.84	0.87	-0.64
	95.80	4	95.79	0.89	-0.76
		AVG	95.80	0.90	-0.67
102		1	93.86	-0.80	3.38
		2	93.72	-0.75	3.35
	L*	3	93.91	-0.84	3.30
	93.82	4	93.80	-0.73	3.35
		AVG	93.82	-0.78	3.35

Appendix E (continued)

103		1	95.15	1.73	-1.38
		2	95.11	1.75	-1.34
	L*	3	95.06	1.60	-1.55
	95.12	4	95.14	1.74	-1.42
		AVG	95.12	1.71	-1.42
104		1	95.69	1.15	-0.66
		2	95.69	1.22	-0.67
	L*	3	95.57	1.13	-0.91
	95.68	4	95.75	1.13	-0.72
		AVG	95.68	1.16	-0.75
105		1	95.99	0.78	-0.70
		2	95.81	0.83	-0.68
	L*	3	95.93	0.75	-0.66
	95.83	4	95.58	0.90	-0.77
		AVG	95.83	0.82	-0.70
106		1	95.01	1.53	-1.47
		2	94.86	1.55	-1.57
	L*	3	94.98	1.58	-1.49
	95.01	4	95.17	1.47	-1.41
		AVG	95.01	1.53	-1.49
107		1	96.23	1.08	-0.96
		2	96.14	1.09	-0.84
	L*	3	96.04	1.02	-1.06
	96.13	4	96.12	1.09	-0.92
		AVG	96.13	1.07	-0.95
108		1	95.82	0.28	2.26
		2	95.79	0.28	2.23
	L*	3	95.69	0.21	2.14
	95.76	4	95.72	0.27	2.27
		AVG	95.76	0.26	2.23
109		1	94.89	0.25	2.37
		2	94.83	0.26	2.39
	L*	3	94.80	0.21	2.33
	94.84	4	94.84	0.29	2.37
		AVG	94.84	0.25	2.37
110		1	93.91	1.08	-2.68
		2	93.84	1.10	-2.78
	L*	3	93.92	1.17	-2.96
	93.88	4	93.85	1.16	-2.88
		AVG	93.88	1.13	-2.83

Appendix E (continued)

111		1	92.75	-0.15	3.47
		2	92.68	-0.14	3.53
	L*	3	92.78	-0.26	3.55
	92.73	4	92.70	-0.18	3.56
	AVG	92.73	-0.18	3.53	
112		1	93.14	0.04	1.60
		2	92.98	0.14	1.59
	L*	3	93.21	-0.01	1.64
	93.15	4	93.27	-0.02	1.65
	AVG	93.15	0.04	1.62	
113		1	94.57	1.71	-1.63
		2	94.61	1.70	-1.74
	L*	3	94.57	1.60	-1.77
	94.59	4	94.60	1.66	-1.65
	AVG	94.59	1.67	-1.70	
114		1	95.95	1.13	2.16
		2	95.99	1.12	2.16
	L*	3	95.81	1.09	1.95
	95.94	4	96.01	1.07	2.13
	AVG	95.94	1.10	2.10	
115		1	96.26	0.71	1.76
		2	96.21	0.76	1.80
	L*	3	96.30	0.60	1.66
	96.27	4	96.30	0.68	1.73
	AVG	96.27	0.69	1.74	
116		1	96.03	0.47	-0.61
		2	95.92	0.53	-0.57
	L*	3	96.01	0.48	-0.71
	95.98	4	95.97	0.48	-0.63
	AVG	95.98	0.49	-0.63	
117		1	97.09	0.93	0.71
		2	97.08	1.00	0.62
	L*	3	96.95	0.78	0.46
	97.00	4	96.87	0.91	0.45
	AVG	97.00	0.91	0.56	
118		1	93.38	-0.89	2.87
		2	93.32	-0.85	2.85
	L*	3	93.37	-0.89	2.82
	93.39	4	93.49	-0.88	2.91
	AVG	93.39	-0.88	2.86	

Appendix E (continued)

119		1	93.45	-1.12	3.57
		2	93.46	-1.14	3.59
	L*	3	93.45	-1.13	3.50
	93.47	4	93.51	-1.11	3.57
		AVG	93.47	-1.13	3.56
120		1	93.27	-1.18	3.27
		2	93.23	-1.14	3.28
	L*	3	93.26	-1.20	3.29
	93.26	4	93.27	-1.15	3.26
		AVG	93.26	-1.17	3.28
121		1	94.82	0.65	-0.75
		2	94.87	0.68	-0.90
	L*	3	94.79	0.71	-1.03
	94.83	4	94.84	0.71	-0.96
		AVG	94.83	0.69	-0.91
122		1	95.80	0.71	-0.39
		2	95.81	0.87	-0.68
	L*	3	95.77	0.80	-0.89
	95.78	4	95.74	0.85	-0.79
		AVG	95.78	0.81	-0.69
123		1	94.62	0.63	1.23
		2	94.59	0.68	1.08
	L*	3	94.56	0.68	0.87
	94.58	4	94.56	0.68	1.08
		AVG	94.58	0.67	1.07
124		1	96.42	1.87	-2.26
		2	96.36	1.86	-2.06
	L*	3	96.18	1.68	-2.41
	96.36	4	96.49	1.80	-2.14
		AVG	96.36	1.80	-2.22
125		1	93.39	0.45	0.00
		2	93.46	0.46	-0.11
	L*	3	93.37	0.45	-0.16
	93.39	4	93.35	0.45	-0.03
		AVG	93.39	0.45	-0.08
126		1	92.68	0.07	3.40
		2	92.70	0.04	3.33
	L*	3	92.66	0.10	3.27
	92.68	4	92.66	0.06	3.37
		AVG	92.68	0.07	3.34

Appendix E (continued)

127		1	97.95	1.44	-2.92
		2	97.88	1.49	-3.00
	L*	3	97.69	1.53	-3.20
	97.84	4	97.82	1.55	-2.98
	AVG	97.84	1.50	-3.03	
128		1	93.83	1.22	0.32
		2	93.87	1.21	0.29
	L*	3	93.90	1.18	0.19
	93.87	4	93.88	1.19	0.33
	AVG	93.87	1.20	0.28	

Appendix F

X-Rite 948 w\Illum. C and calc. WI from Y, x, y vs. Visual Ranking

Appendix F

X-Rite 948 w\Illum. C and calc. WI from Y, x, y vs. Visual Ranking

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CIE WI= @ROUND((D20)+(800*(0.3101-(E20)))+(
          (1700*(0.3163-(F20))),2)
AVG Y = @ROUND((@SUM(D16..D19)/4),2)
AVG x = @ROUND((@SUM(E16..E19)/4),4)
AVG y = @ROUND((@SUM(F16..F19)/4),4)

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GRADE CODE	SAMPLE	Y ILL C X-RITE	x ILL C X-RITE	y ILL C X-RITE
=====	=====	=====	=====	=====
1	1	93.14	0.3110	0.3146
	2	93.02	0.3107	0.3145
CIE WI	3	93.14	0.3106	0.3143
95.99	4	92.67	0.3102	0.3138
	AVG	92.99	0.3106	0.3143
2	1	91.70	0.3086	0.3111
	2	91.84	0.3090	0.3115
CIE WI	3	91.75	0.3085	0.3113
101.21	4	91.73	0.3088	0.3116
	AVG	91.76	0.3087	0.3114
3	1	91.23	0.3199	0.3277
	2	91.00	0.3201	0.3277
CIE WI	3	91.23	0.3201	0.3280
63.76	4	90.79	0.3197	0.3275
	AVG	91.06	0.3200	0.3277
4	1	91.75	0.3181	0.3257
	2	91.79	0.3180	0.3258
CIE WI	3	91.66	0.3180	0.3258
69.24	4	91.94	0.3182	0.3260
	AVG	91.79	0.3181	0.3258
5	1	92.42	0.3155	0.3206
	2	92.68	0.3156	0.3207
CIE WI	3	91.97	0.3148	0.3202
80.89	4	92.70	0.3157	0.3209
	AVG	92.44	0.3154	0.3206
6	1	91.24	0.3137	0.3183
	2	90.12	0.3131	0.3174
CIE WI	3	89.69	0.3123	0.3170
85.71	4	91.92	0.3138	0.3186
	AVG	90.74	0.3132	0.3178

Appendix F (continued)

7	1	93.96	0.3128	0.3180
	2	94.13	0.3131	0.3185
	CIE WI	3	93.77	0.3126
	88.99	4	93.98	0.3178
	AVG	93.96	0.3124	0.3177
			0.3127	0.3180
8	1	93.66	0.3132	0.3184
	2	93.56	0.3132	0.3184
	CIE WI	3	93.62	0.3123
	87.77	4	93.80	0.3177
	AVG	93.66	0.3134	0.3189
			0.3130	0.3184
9	1	94.00	0.3128	0.3183
	2	93.96	0.3128	0.3182
	CIE WI	3	93.80	0.3121
	88.69	4	93.93	0.3180
	AVG	93.92	0.3125	0.3182
			0.3126	0.3182
10	1	93.40	0.3133	0.3185
	2	93.30	0.3132	0.3183
	CIE WI	3	93.39	0.3128
	87.41	4	93.43	0.3183
	AVG	93.38	0.3130	0.3184
			0.3131	0.3184
11	1	92.47	0.3140	0.3186
	2	92.26	0.3137	0.3185
	CIE WI	3	90.38	0.3125
	86.04	4	92.15	0.3169
	AVG	91.82	0.3138	0.3185
			0.3135	0.3181
12	1	92.60	0.3124	0.3170
	2	92.43	0.3124	0.3172
	CIE WI	3	92.55	0.3122
	89.68	4	91.92	0.3171
	AVG	92.38	0.3118	0.3164
			0.3122	0.3169
13	1	90.12	0.3194	0.3250
	2	89.56	0.3193	0.3250
	CIE WI	3	89.94	0.3193
	67.86	4	89.11	0.3252
	AVG	89.68	0.3185	0.3244
			0.3191	0.3249
14	1	90.35	0.3198	0.3251
	2	90.37	0.3197	0.3251
	CIE WI	3	89.99	0.3190
	68.09	4	90.21	0.3246
	AVG	90.23	0.3193	0.3248
			0.3195	0.3249

Appendix F (continued)

15	1	93.26	0.3137	0.3190
	2	93.34	0.3134	0.3188
CIE WI	3	92.21	0.3121	0.3183
86.50	4	92.44	0.3130	0.3181
	AVG	92.81	0.3131	0.3186
16	1	95.15	0.3131	0.3192
	2	95.11	0.3131	0.3192
CIE WI	3	95.10	0.3130	0.3192
87.96	4	94.78	0.3128	0.3189
	AVG	95.04	0.3130	0.3191
17	1	90.35	0.3200	0.3281
	2	90.28	0.3198	0.3281
CIE WI	3	90.09	0.3195	0.3280
62.49	4	89.53	0.3194	0.3276
	AVG	90.06	0.3197	0.3280
18	1	94.18	0.3133	0.3193
	2	94.26	0.3133	0.3194
CIE WI	3	94.31	0.3135	0.3196
86.33	4	94.22	0.3133	0.3194
	AVG	94.24	0.3134	0.3194
19	1	94.58	0.3135	0.3192
	2	93.64	0.3127	0.3183
CIE WI	3	93.65	0.3126	0.3185
87.76	4	93.75	0.3128	0.3184
	AVG	93.91	0.3129	0.3186
20	1	93.26	0.3208	0.3292
	2	93.50	0.3209	0.3293
CIE WI	3	93.38	0.3206	0.3292
62.72	4	93.37	0.3208	0.3294
	AVG	93.38	0.3208	0.3293
21	1	92.62	0.3221	0.3301
	2	91.95	0.3215	0.3297
CIE WI	3	92.24	0.3217	0.3300
59.83	4	91.80	0.3211	0.3296
	AVG	92.15	0.3216	0.3299
22	1	87.93	0.3134	0.3175
	2	87.89	0.3134	0.3175
CIE WI	3	88.19	0.3133	0.3176
83.34	4	87.76	0.3132	0.3172
	AVG	87.94	0.3133	0.3175

Appendix F (continued)

23	1	87.30	0.3129	0.3164
	2	87.40	0.3131	0.3168
CIE WI	3	87.49	0.3129	0.3167
84.47	4	87.00	0.3130	0.3166
	AVG	87.30	0.3130	0.3166
24	1	86.61	0.3130	0.3171
	2	86.60	0.3134	0.3178
CIE WI	3	86.68	0.3128	0.3172
82.12	4	86.65	0.3136	0.3180
	AVG	86.64	0.3132	0.3175
25	1	87.85	0.3128	0.3159
	2	87.56	0.3127	0.3157
CIE WI	3	87.94	0.3126	0.3160
86.52	4	87.64	0.3125	0.3154
	AVG	87.75	0.3127	0.3158
26	1	87.02	0.3127	0.3167
	2	87.31	0.3127	0.3169
CIE WI	3	87.20	0.3128	0.3170
83.98	4	87.10	0.3129	0.3169
	AVG	87.16	0.3128	0.3169
27	1	88.16	0.3132	0.3173
	2	88.08	0.3133	0.3172
CIE WI	3	88.07	0.3128	0.3170
84.55	4	87.91	0.3128	0.3166
	AVG	88.06	0.3130	0.3170
28	1	87.68	0.3124	0.3160
	2	87.87	0.3125	0.3161
CIE WI	3	87.69	0.3121	0.3160
86.45	4	87.55	0.3120	0.3157
	AVG	87.70	0.3123	0.3160
29	1	87.20	0.3127	0.3173
	2	87.24	0.3127	0.3172
CIE WI	3	87.17	0.3126	0.3173
83.61	4	86.95	0.3125	0.3170
	AVG	87.14	0.3126	0.3172
30	1	87.27	0.3092	0.3139
	2	87.53	0.3090	0.3138
CIE WI	3	87.08	0.3087	0.3131
92.78	4	87.37	0.3089	0.3135
	AVG	87.31	0.3090	0.3136

Appendix F (continued)

31	1	86.40	0.3089	0.3126
	2	86.90	0.3081	0.3117
CIE WI	3	86.61	0.3085	0.3119
95.05	4	86.59	0.3085	0.3122
	AVG	86.63	0.3085	0.3121
32	1	87.32	0.3101	0.3146
	2	87.43	0.3098	0.3143
CIE WI	3	87.68	0.3097	0.3144
90.72	4	87.56	0.3099	0.3145
	AVG	87.50	0.3099	0.3145
33	1	87.38	0.3097	0.3139
	2	87.13	0.3097	0.3139
CIE WI	3	87.30	0.3097	0.3138
91.86	4	87.34	0.3095	0.3136
	AVG	87.29	0.3097	0.3138
34	1	88.47	0.3087	0.3138
	2	88.55	0.3089	0.3140
CIE WI	3	88.54	0.3089	0.3141
93.40	4	88.54	0.3090	0.3142
	AVG	88.53	0.3089	0.3140
35	1	87.14	0.3094	0.3141
	2	87.00	0.3094	0.3142
CIE WI	3	87.09	0.3095	0.3143
91.22	4	87.12	0.3094	0.3142
	AVG	87.09	0.3094	0.3142
36	1	88.25	0.3105	0.3145
	2	88.53	0.3108	0.3150
CIE WI	3	88.40	0.3103	0.3145
90.68	4	88.24	0.3106	0.3147
	AVG	88.36	0.3106	0.3147
37	1	87.86	0.3093	0.3133
	2	87.85	0.3091	0.3132
CIE WI	3	87.97	0.3091	0.3132
93.69	4	87.80	0.3093	0.3134
	AVG	87.87	0.3092	0.3133
38	1	84.20	0.3117	0.3186
	2	84.30	0.3120	0.3189
CIE WI	3	84.37	0.3118	0.3188
78.71	4	84.41	0.3118	0.3187
	AVG	84.32	0.3118	0.3188

Appendix F (continued)

39	1	85.07	0.3119	0.3184
	2	85.02	0.3122	0.3186
CIE WI	3	84.99	0.3120	0.3184
79.63	4	84.81	0.3121	0.3185
	AVG	84.97	0.3121	0.3185
40	1	83.89	0.3118	0.3184
	2	84.01	0.3119	0.3185
CIE WI	3	83.79	0.3118	0.3185
78.66	4	83.66	0.3119	0.3185
	AVG	83.84	0.3119	0.3185
41	1	85.60	0.3108	0.3174
	2	85.59	0.3110	0.3176
CIE WI	3	85.57	0.3111	0.3177
82.64	4	85.51	0.3110	0.3175
	AVG	85.57	0.3110	0.3176
42	1	83.56	0.3129	0.3187
	2	83.51	0.3132	0.3187
CIE WI	3	83.47	0.3127	0.3184
77.51	4	83.40	0.3128	0.3182
	AVG	83.49	0.3129	0.3185
43	1	83.36	0.3123	0.3185
	2	83.25	0.3124	0.3186
CIE WI	3	83.41	0.3120	0.3184
78.06	4	83.21	0.3122	0.3182
	AVG	83.31	0.3122	0.3184
44	1	83.86	0.3133	0.3190
	2	84.04	0.3131	0.3190
CIE WI	3	84.03	0.3127	0.3186
77.22	4	83.91	0.3130	0.3189
	AVG	83.96	0.3130	0.3189
45	1	94.42	0.3092	0.3131
	2	94.73	0.3092	0.3132
CIE WI	3	94.46	0.3084	0.3127
101.24	4	94.05	0.3085	0.3124
	AVG	94.42	0.3088	0.3129
46	1	95.10	0.3089	0.3124
	2	95.29	0.3088	0.3124
CIE WI	3	94.09	0.3078	0.3114
103.47	4	94.71	0.3082	0.3119
	AVG	94.80	0.3084	0.3120

Appendix F (continued)

47	1	94.82	0.3124	0.3175
	2	94.88	0.3123	0.3173
CIE WI	3	94.06	0.3116	0.3170
91.38	4	94.26	0.3120	0.3171
	AVG	94.51	0.3121	0.3172
48	1	95.00	0.3117	0.3161
	2	94.85	0.3116	0.3160
CIE WI	3	94.60	0.3113	0.3159
94.27	4	94.39	0.3112	0.3157
	AVG	94.71	0.3115	0.3159
49	1	95.20	0.3113	0.3167
	2	94.98	0.3115	0.3169
CIE WI	3	95.27	0.3110	0.3168
93.37	4	95.27	0.3114	0.3169
	AVG	95.18	0.3113	0.3168
50	1	94.61	0.3088	0.3122
	2	93.88	0.3092	0.3122
CIE WI	3	93.15	0.3084	0.3115
101.94	4	94.02	0.3094	0.3126
	AVG	93.92	0.3090	0.3121
51	1	88.67	0.3142	0.3179
	2	88.62	0.3142	0.3177
CIE WI	3	88.87	0.3144	0.3184
82.73	4	88.74	0.3140	0.3175
	AVG	88.73	0.3142	0.3179
52	1	89.40	0.3139	0.3181
	2	89.36	0.3137	0.3176
CIE WI	3	88.90	0.3132	0.3176
83.81	4	89.30	0.3138	0.3180
	AVG	89.24	0.3137	0.3178
53	1	87.71	0.3108	0.3138
	2	87.59	0.3109	0.3140
CIE WI	3	87.57	0.3109	0.3141
90.86	4	87.49	0.3108	0.3139
	AVG	87.59	0.3109	0.3140
54	1	90.62	0.3133	0.3207
	2	90.55	0.3134	0.3208
CIE WI	3	90.58	0.3133	0.3206
80.51	4	90.46	0.3133	0.3206
	AVG	90.55	0.3133	0.3207

Appendix F (continued)

55	1	91.54	0.3144	0.3193
	2	91.41	0.3148	0.3199
CIE WI	3	91.41	0.3140	0.3192
82.60	4	91.56	0.3144	0.3195
	AVG	91.48	0.3144	0.3195
56	1	88.73	0.3142	0.3171
	2	88.61	0.3144	0.3174
CIE WI	3	88.67	0.3141	0.3174
83.60	4	88.61	0.3143	0.3174
	AVG	88.66	0.3143	0.3173
57	1	87.53	0.3102	0.3160
	2	87.61	0.3103	0.3162
CIE WI	3	87.52	0.3103	0.3161
87.73	4	87.54	0.3102	0.3160
	AVG	87.55	0.3103	0.3161
58	1	85.67	0.3096	0.3161
	2	85.80	0.3097	0.3163
CIE WI	3	85.50	0.3096	0.3161
86.15	4	85.65	0.3097	0.3162
	AVG	85.66	0.3097	0.3162
59	1	93.70	0.3133	0.3190
	2	93.83	0.3133	0.3191
CIE WI	3	93.71	0.3128	0.3187
86.90	4	93.63	0.3131	0.3187
	AVG	93.72	0.3131	0.3189
60	1	92.64	0.3130	0.3174
	2	92.55	0.3131	0.3175
CIE WI	3	91.97	0.3127	0.3170
88.87	4	92.07	0.3121	0.3166
	AVG	92.31	0.3127	0.3171
61	1	94.86	0.3145	0.3221
	2	94.38	0.3144	0.3221
CIE WI	3	93.39	0.3133	0.3209
82.11	4	93.34	0.3133	0.3209
	AVG	93.99	0.3139	0.3215
62	1	95.97	0.3073	0.3105
	2	95.69	0.3072	0.3103
CIE WI	3	93.62	0.3056	0.3085
109.18	4	93.37	0.3056	0.3085
	AVG	94.66	0.3064	0.3095

Appendix F (continued)

63	1	90.52	0.3095	0.3143
	2	90.43	0.3095	0.3143
CIE WI	3	90.18	0.3089	0.3140
94.32	4	90.31	0.3096	0.3145
	AVG	90.36	0.3094	0.3143
64	1	82.57	0.3116	0.3176
	2	82.67	0.3118	0.3180
CIE WI	3	82.51	0.3117	0.3177
78.76	4	82.60	0.3117	0.3178
	AVG	82.59	0.3117	0.3178
65	1	92.26	0.3074	0.3110
	2	92.29	0.3073	0.3109
CIE WI	3	91.67	0.3069	0.3105
103.84	4	92.45	0.3072	0.3109
	AVG	92.17	0.3072	0.3108
66	1	81.36	0.3134	0.3205
	2	81.40	0.3136	0.3206
CIE WI	3	81.21	0.3134	0.3205
71.45	4	81.28	0.3135	0.3205
	AVG	81.31	0.3135	0.3205
67	1	83.36	0.3138	0.3197
	2	83.43	0.3138	0.3197
CIE WI	3	83.47	0.3137	0.3195
75.08	4	83.32	0.3136	0.3192
	AVG	83.40	0.3137	0.3195
68	1	93.82	0.3069	0.3100
	2	93.96	0.3071	0.3105
CIE WI	3	92.09	0.3063	0.3092
106.90	4	93.31	0.3066	0.3097
	AVG	93.30	0.3067	0.3099
69	1	91.31	0.3189	0.3273
	2	91.27	0.3188	0.3273
CIE WI	3	91.05	0.3186	0.3270
65.65	4	90.93	0.3187	0.3271
	AVG	91.14	0.3188	0.3272
70	1	90.95	0.3188	0.3258
	2	90.27	0.3184	0.3253
CIE WI	3	90.21	0.3179	0.3250
68.33	4	90.66	0.3188	0.3256
	AVG	90.52	0.3185	0.3254

Appendix F (continued)

71	1	92.09	0.3099	0.3133
	2	92.02	0.3100	0.3135
CIE WI	3	91.49	0.3090	0.3125
97.61	4	91.81	0.3099	0.3132
	AVG	91.85	0.3097	0.3131
72	1	92.25	0.3095	0.3125
	2	92.01	0.3096	0.3126
CIE WI	3	92.29	0.3087	0.3123
99.29	4	91.88	0.3091	0.3124
	AVG	92.11	0.3092	0.3125
73	1	91.14	0.3196	0.3277
	2	91.01	0.3199	0.3281
CIE WI	3	89.42	0.3181	0.3262
64.30	4	91.23	0.3197	0.3278
	AVG	90.70	0.3193	0.3275
74	1	91.50	0.3211	0.3298
	2	91.85	0.3209	0.3297
CIE WI	3	90.91	0.3200	0.3288
60.43	4	91.45	0.3211	0.3297
	AVG	91.43	0.3208	0.3295
75	1	91.44	0.3146	0.3217
	2	91.48	0.3147	0.3219
CIE WI	3	90.53	0.3136	0.3210
78.82	4	90.61	0.3141	0.3212
	AVG	91.02	0.3143	0.3215
76	1	91.28	0.3161	0.3232
	2	91.09	0.3160	0.3230
CIE WI	3	90.21	0.3150	0.3223
75.13	4	90.75	0.3158	0.3229
	AVG	90.83	0.3157	0.3229
77	1	86.98	0.3168	0.3224
	2	86.94	0.3169	0.3225
CIE WI	3	87.10	0.3161	0.3221
71.39	4	86.80	0.3167	0.3224
	AVG	86.96	0.3166	0.3224
78	1	86.36	0.3165	0.3229
	2	86.38	0.3165	0.3229
CIE WI	3	86.19	0.3163	0.3227
70.19	4	86.17	0.3163	0.3226
	AVG	86.28	0.3164	0.3228

Appendix F (continued)

79	1	86.09	0.3158	0.3220
	2	86.13	0.3158	0.3220
CIE WI	3	85.68	0.3155	0.3217
71.95	4	85.88	0.3157	0.3217
	AVG	85.95	0.3157	0.3219
80	1	90.93	0.3137	0.3178
	2	91.07	0.3138	0.3180
CIE WI	3	91.20	0.3134	0.3179
85.45	4	90.99	0.3138	0.3180
	AVG	91.05	0.3137	0.3179
81	1	86.04	0.3137	0.3176
	2	86.11	0.3137	0.3177
CIE WI	3	86.04	0.3136	0.3180
80.60	4	85.94	0.3139	0.3177
	AVG	86.03	0.3137	0.3178
82	1	80.87	0.3162	0.3244
	2	81.14	0.3161	0.3245
CIE WI	3	81.22	0.3161	0.3243
62.30	4	81.26	0.3165	0.3246
	AVG	81.12	0.3162	0.3245
83	1	88.27	0.3138	0.3183
	2	88.24	0.3138	0.3181
CIE WI	3	88.33	0.3136	0.3180
81.98	4	87.84	0.3139	0.3182
	AVG	88.17	0.3138	0.3182
84	1	84.24	0.3124	0.3155
	2	84.19	0.3124	0.3156
CIE WI	3	84.31	0.3122	0.3153
83.75	4	84.18	0.3125	0.3156
	AVG	84.23	0.3124	0.3155
85	1	91.28	0.3125	0.3163
	2	91.34	0.3124	0.3163
CIE WI	3	90.38	0.3113	0.3155
89.60	4	91.43	0.3125	0.3165
	AVG	91.11	0.3122	0.3162
86	1	90.70	0.3187	0.3264
	2	90.78	0.3187	0.3264
CIE WI	3	89.54	0.3175	0.3254
66.99	4	89.80	0.3182	0.3260
	AVG	90.21	0.3183	0.3261

Appendix F (continued)

87	1	81.00	0.3140	0.3215
	2	81.04	0.3141	0.3214
CIE WI	3	81.09	0.3140	0.3215
69.02	4	81.10	0.3143	0.3217
	AVG	81.06	0.3141	0.3215
88	1	86.97	0.3119	0.3165
	2	87.04	0.3118	0.3164
CIE WI	3	87.07	0.3117	0.3163
85.48	4	86.94	0.3118	0.3164
	AVG	87.01	0.3118	0.3164
89	1	84.55	0.3128	0.3177
	2	84.65	0.3127	0.3176
CIE WI	3	84.53	0.3125	0.3175
80.24	4	84.39	0.3128	0.3176
	AVG	84.53	0.3127	0.3176
90	1	94.12	0.3098	0.3128
	2	94.30	0.3097	0.3128
CIE WI	3	94.12	0.3093	0.3124
100.76	4	94.41	0.3097	0.3128
	AVG	94.24	0.3096	0.3127
91	1	83.61	0.3120	0.3171
	2	83.69	0.3117	0.3167
CIE WI	3	83.64	0.3115	0.3169
81.26	4	83.63	0.3118	0.3170
	AVG	83.64	0.3118	0.3169
92	1	86.19	0.3120	0.3171
	2	86.19	0.3119	0.3172
CIE WI	3	85.88	0.3116	0.3169
83.33	4	85.93	0.3118	0.3170
	AVG	86.05	0.3118	0.3171
93	1	89.43	0.3186	0.3252
	2	89.21	0.3183	0.3247
CIE WI	3	89.22	0.3179	0.3245
68.31	4	89.42	0.3184	0.3249
	AVG	89.32	0.3183	0.3248
94	1	90.42	0.3089	0.3115
	2	90.37	0.3089	0.3115
CIE WI	3	90.36	0.3086	0.3114
99.57	4	90.34	0.3087	0.3114
	AVG	90.37	0.3088	0.3115

Appendix F (continued)

95	1	86.56	0.3089	0.3135
	2	86.50	0.3090	0.3134
CIE WI	3	86.62	0.3089	0.3135
91.99	4	86.41	0.3091	0.3138
	AVG	86.52	0.3090	0.3136
96	1	86.23	0.3120	0.3153
	2	86.30	0.3119	0.3151
CIE WI	3	86.60	0.3116	0.3150
86.77	4	86.24	0.3121	0.3154
	AVG	86.34	0.3119	0.3152
97	1	82.09	0.3137	0.3185
	2	82.20	0.3137	0.3184
CIE WI	3	82.26	0.3135	0.3183
75.81	4	82.18	0.3136	0.3183
	AVG	82.18	0.3136	0.3184
98	1	85.45	0.3138	0.3207
	2	85.51	0.3139	0.3207
CIE WI	3	85.65	0.3138	0.3207
74.98	4	85.39	0.3139	0.3207
	AVG	85.50	0.3139	0.3207
99	1	89.75	0.3135	0.3183
	2	89.80	0.3135	0.3182
CIE WI	3	89.25	0.3130	0.3179
84.14	4	89.24	0.3129	0.3177
	AVG	89.51	0.3132	0.3180
100	1	92.69	0.3107	0.3135
	2	92.83	0.3109	0.3136
CIE WI	3	92.23	0.3102	0.3131
97.09	4	92.50	0.3105	0.3133
	AVG	92.56	0.3106	0.3134
101	1	89.52	0.3101	0.3144
	2	89.47	0.3101	0.3144
CIE WI	3	89.61	0.3101	0.3144
92.76	4	89.50	0.3099	0.3142
	AVG	89.53	0.3101	0.3144
102	1	84.95	0.3152	0.3230
	2	84.62	0.3152	0.3229
CIE WI	3	85.06	0.3150	0.3229
69.56	4	84.81	0.3152	0.3229
	AVG	84.86	0.3152	0.3229

Appendix F (continued)

103	1	87.99	0.3099	0.3126
	2	87.88	0.3100	0.3126
CIE WI	3	87.76	0.3094	0.3123
94.60	4	87.95	0.3098	0.3125
	AVG	87.90	0.3098	0.3125
104	1	89.27	0.3104	0.3142
	2	89.26	0.3105	0.3142
CIE WI	3	88.98	0.3099	0.3138
92.81	4	89.42	0.3103	0.3142
	AVG	89.23	0.3103	0.3141
105	1	89.97	0.3098	0.3144
	2	89.55	0.3099	0.3144
CIE WI	3	89.85	0.3099	0.3145
92.98	4	89.00	0.3099	0.3142
	AVG	89.59	0.3099	0.3144
106	1	87.64	0.3094	0.3125
	2	87.28	0.3093	0.3123
CIE WI	3	87.57	0.3095	0.3124
94.65	4	88.02	0.3095	0.3126
	AVG	87.63	0.3094	0.3125
107	1	90.58	0.3098	0.3138
	2	90.35	0.3100	0.3140
CIE WI	3	90.10	0.3095	0.3136
94.82	4	90.30	0.3098	0.3138
	AVG	90.33	0.3098	0.3138
108	1	89.57	0.3145	0.3201
	2	89.51	0.3145	0.3201
CIE WI	3	89.26	0.3142	0.3200
79.52	4	89.33	0.3145	0.3202
	AVG	89.42	0.3144	0.3201
109	1	87.36	0.3147	0.3204
	2	87.21	0.3148	0.3204
CIE WI	3	87.15	0.3146	0.3204
76.59	4	87.23	0.3148	0.3204
	AVG	87.24	0.3147	0.3204
110	1	85.07	0.3066	0.3105
	2	84.89	0.3065	0.3103
CIE WI	3	85.08	0.3062	0.3099
98.32	4	84.92	0.3063	0.3101
	AVG	84.99	0.3064	0.3102

Appendix F (continued)

111	1	82.39	0.3163	0.3223
	2	82.23	0.3164	0.3230
CIE WI	3	82.46	0.3163	0.3230
66.25	4	82.28	0.3164	0.3230
	AVG	82.34	0.3164	0.3228
112	1	83.29	0.3131	0.3192
	2	82.92	0.3132	0.3191
CIE WI	3	83.45	0.3131	0.3193
75.98	4	83.58	0.3131	0.3193
	AVG	83.31	0.3131	0.3192
113	1	86.59	0.3094	0.3121
	2	86.69	0.3092	0.3119
CIE WI	3	86.60	0.3090	0.3119
94.67	4	86.68	0.3093	0.3121
	AVG	86.64	0.3092	0.3120
114	1	89.90	0.3155	0.3194
	2	90.00	0.3154	0.3194
CIE WI	3	89.54	0.3150	0.3191
80.61	4	90.03	0.3153	0.3194
	AVG	89.87	0.3153	0.3193
115	1	90.63	0.3142	0.3189
	2	90.52	0.3143	0.3190
CIE WI	3	90.73	0.3139	0.3188
83.03	4	90.72	0.3141	0.3189
	AVG	90.65	0.3141	0.3189
116	1	90.09	0.3096	0.3147
	2	89.81	0.3097	0.3148
CIE WI	3	90.04	0.3094	0.3146
93.09	4	89.94	0.3096	0.3147
	AVG	89.97	0.3096	0.3147
117	1	92.66	0.3125	0.3169
	2	92.65	0.3125	0.3167
CIE WI	3	92.29	0.3119	0.3165
90.16	4	92.11	0.3121	0.3164
	AVG	92.43	0.3123	0.3166
118	1	83.83	0.3141	0.3221
	2	83.70	0.3142	0.3221
CIE WI	3	83.82	0.3140	0.3220
70.72	4	84.09	0.3143	0.3222
	AVG	83.86	0.3142	0.3221

Appendix F (continued)

119	1	84.01	0.3151	0.3236
	2	84.03	0.3151	0.3236
CIE WI	3	83.99	0.3150	0.3235
67.63	4	84.14	0.3151	0.3236
	AVG	84.04	0.3151	0.3236
120	1	83.58	0.3145	0.3231
	2	83.50	0.3146	0.3231
CIE WI	3	83.56	0.3145	0.3231
68.48	4	83.59	0.3145	0.3230
	AVG	83.56	0.3145	0.3231
121	1	87.19	0.3096	0.3144
	2	87.31	0.3093	0.3141
CIE WI	3	87.13	0.3091	0.3138
91.60	4	87.23	0.3093	0.3139
	AVG	87.22	0.3093	0.3141
122	1	89.54	0.3103	0.3150
	2	89.55	0.3100	0.3144
CIE WI	3	89.47	0.3095	0.3140
92.88	4	89.38	0.3098	0.3142
	AVG	89.49	0.3099	0.3144
123	1	86.71	0.3132	0.3181
	2	86.65	0.3130	0.3177
CIE WI	3	86.59	0.3126	0.3173
81.94	4	86.59	0.3130	0.3177
	AVG	86.64	0.3130	0.3177
124	1	91.02	0.3085	0.3109
	2	90.89	0.3088	0.3113
CIE WI	3	90.44	0.3080	0.3107
101.18	4	91.19	0.3086	0.3112
	AVG	90.89	0.3085	0.3110
125	1	83.85	0.3107	0.3159
	2	84.02	0.3105	0.3157
CIE WI	3	83.82	0.3104	0.3156
84.31	4	83.76	0.3106	0.3158
	AVG	83.86	0.3106	0.3158
126	1	82.23	0.3165	0.3225
	2	82.28	0.3163	0.3224
CIE WI	3	82.19	0.3162	0.3223
66.81	4	82.19	0.3164	0.3225
	AVG	82.22	0.3164	0.3224

Appendix F (continued)

127	1	94.80	0.3068	0.3101
	2	94.62	0.3067	0.3099
CIE WI	3	94.15	0.3064	0.3095
108.11	4	94.47	0.3068	0.3099
	AVG	94.51	0.3067	0.3099
128	1	84.88	0.3123	0.3160
	2	84.97	0.3122	0.3159
CIE WI	3	85.03	0.3120	0.3158
83.97	4	84.98	0.3123	0.3160
	AVG	84.97	0.3122	0.3159

Appendix G

X-Rite 948 w\Illuminant D₆₅ displaying L* vs. Visual Ranking

Appendix G

X-Rite 948 w\Illuminant D₆₅ displaying L* vs. Visual Ranking

AVG L* = @ROUND(@SUM(D16..D19)/4,2)
 AVG a* = @ROUND(@SUM(E16..E19)/4,2)
 AVG b* = @ROUND(@SUM(F16..F19)/4,2)

GRADE CODE	SAMPLE	L* ILL D65 X-RITE	a* ILL D65 X-RITE	b* ILL D65 X-RITE
=====	=====	=====	=====	=====
1	1	97.27	1.22	-0.46
	2	97.25	1.16	-0.48
	L*	97.11	1.13	-0.77
	97.21	97.19	1.02	-0.81
	AVG	97.21	1.13	-0.63
2	1	96.74	1.64	-1.88
	2	96.66	1.70	-1.92
	L*	96.69	1.55	-2.04
	96.59	96.26	1.58	-2.36
	AVG	96.59	1.62	-2.05
3	1	96.53	-0.52	6.01
	2	96.48	-0.50	5.99
	L*	96.20	-0.72	5.53
	96.44	96.56	-0.62	6.08
	AVG	96.44	-0.59	5.90
4	1	96.65	-0.51	4.95
	2	96.74	-0.60	4.98
	L*	96.65	-0.66	4.88
	96.69	96.73	-0.59	5.00
	AVG	96.69	-0.59	4.95
5	1	97.03	0.62	2.67
	2	97.08	0.61	2.57
	L*	96.57	0.32	1.93
	96.95	97.11	0.65	2.78
	AVG	96.95	0.55	2.49
6	1	96.52	0.82	1.40
	2	96.27	0.96	1.26
	L*	95.99	0.65	0.76
	96.39	96.78	0.63	1.44
	AVG	96.39	0.77	1.22

Appendix G (continued)

7		1	97.66	0.47	1.23
		2	97.71	0.41	1.39
	L*	3	97.44	0.40	1.02
	97.58	4	97.49	0.37	1.06
		AVG	97.58	0.41	1.18
8		1	97.37	0.37	1.41
		2	97.55	0.40	1.60
	L*	3	97.28	0.31	0.93
	97.40	4	97.40	0.38	1.30
		AVG	97.40	0.37	1.31
9		1	97.69	0.30	1.41
		2	97.70	0.30	1.50
	L*	3	97.56	0.15	1.18
	97.65	4	97.64	0.17	1.29
		AVG	97.65	0.23	1.35
10		1	97.43	0.49	1.53
		2	97.42	0.52	1.46
	L*	3	97.26	0.29	1.36
	97.38	4	97.41	0.37	1.41
		AVG	97.38	0.42	1.44
11		1	96.97	0.81	1.41
		2	96.94	0.70	1.54
	L*	3	95.72	0.75	0.36
	96.61	4	96.82	0.85	1.58
		AVG	96.61	0.78	1.22
12		1	96.98	0.89	0.69
		2	97.08	0.83	0.89
	L*	3	96.83	0.62	0.61
	96.93	4	96.83	0.72	0.50
		AVG	96.93	0.77	0.67
13		1	95.73	0.33	4.55
		2	95.63	0.36	4.53
	L*	3	95.18	0.27	3.87
	95.50	4	95.45	0.29	4.29
		AVG	95.50	0.31	4.31
14		1	96.01	0.70	4.92
		2	95.97	0.68	5.08
	L*	3	95.91	0.36	4.57
	96.01	4	96.15	0.61	4.99
		AVG	96.01	0.59	4.89

Appendix G (continued)

15	1	97.31	0.41	1.66
	2	97.44	0.44	1.58
	L*	3	96.85	0.48
	97.22	4	97.29	0.53
	AVG	97.22	0.47	1.46
16	1	98.11	0.05	1.74
	2	98.14	0.05	1.78
	L*	3	98.12	-0.02
	98.13	4	98.14	0.02
	AVG	98.13	0.03	1.76
17	1	96.20	-0.76	6.09
	2	96.23	-0.76	6.13
	L*	3	95.66	-0.86
	95.99	4	95.88	-0.80
	AVG	95.99	-0.80	5.85
18	1	97.79	0.06	1.85
	2	97.72	0.04	1.94
	L*	3	97.80	-0.09
	97.77	4	97.75	0.06
	AVG	97.77	0.02	1.91
19	1	97.90	0.30	1.75
	2	97.35	0.23	1.12
	L*	3	97.67	0.17
	97.64	4	97.63	0.15
	AVG	97.64	0.21	1.44
20	1	97.47	-0.90	6.85
	2	97.46	-0.88	6.85
	L*	3	97.11	-1.14
	97.38	4	97.48	-0.88
	AVG	97.38	-0.95	6.72
21	1	97.14	-0.61	7.29
	2	97.13	-0.60	7.29
	L*	3	96.93	-0.85
	97.02	4	96.87	-0.84
	AVG	97.02	-0.73	7.19
22	1	95.08	1.06	1.31
	2	95.17	1.06	1.04
	L*	3	95.17	0.97
	95.11	4	95.03	1.11
	AVG	95.11	1.05	1.05

Appendix G (continued)

23	1	94.91	1.27	0.73
	2	94.85	1.27	0.74
	L*	3	94.96	1.24
	94.88	4	94.79	1.31
	AVG	94.88	1.27	0.66
24	1	94.67	0.97	1.00
	2	94.66	0.99	0.95
	L*	3	94.70	0.87
	94.67	4	94.63	0.95
	AVG	94.67	0.95	1.02
25	1	95.05	1.59	0.42
	2	95.05	1.61	0.26
	L*	3	95.18	1.50
	95.10	4	95.12	1.59
	AVG	95.10	1.57	0.33
26	1	94.78	1.05	0.92
	2	94.87	0.98	0.93
	L*	3	94.83	1.03
	94.83	4	94.84	1.01
	AVG	94.83	1.02	0.81
27	1	95.26	1.18	0.78
	2	95.29	1.09	0.95
	L*	3	95.31	0.96
	95.23	4	95.04	1.17
	AVG	95.23	1.10	0.80
28	1	95.04	1.28	0.40
	2	95.13	1.20	0.46
	L*	3	95.06	1.15
	95.08	4	95.08	1.33
	AVG	95.08	1.24	0.28
29	1	94.79	0.81	0.94
	2	94.85	0.72	1.12
	L*	3	94.80	0.74
	94.78	4	94.69	0.82
	AVG	94.78	0.77	0.76
30	1	94.88	0.59	-0.86
	2	94.91	0.63	-0.98
	L*	3	94.55	0.63
	94.82	4	94.95	0.59
	AVG	94.82	0.61	-1.22

Appendix G (continued)

31		1	94.56	1.14	-1.58
		2	94.70	1.21	-1.88
	L*	3	94.60	1.27	-1.89
	94.63	4	94.64	1.20	-1.76
		AVG	94.63	1.21	-1.78
32		1	94.91	0.74	-0.49
		2	94.95	0.72	-0.44
	L*	3	95.02	0.64	-0.64
	94.97	4	94.99	0.65	-0.41
		AVG	94.97	0.69	-0.50
33		1	94.99	0.82	-0.78
		2	94.83	0.90	-0.82
	L*	3	94.99	0.84	-0.82
	94.93	4	94.91	0.89	-0.86
		AVG	94.93	0.86	-0.82
34		1	95.37	0.40	-0.85
		2	95.40	0.41	-0.92
	L*	3	95.28	0.42	-0.98
	95.35	4	95.34	0.42	-0.97
		AVG	95.35	0.41	-0.93
35		1	94.84	0.58	-0.71
		2	94.80	0.58	-0.73
	L*	3	94.74	0.49	-0.68
	94.80	4	94.83	0.49	-0.58
		AVG	94.80	0.54	-0.68
36			0.49	-0.58	
		1	95.29	1.01	-0.47
		2	95.41	0.86	-0.30
	L*	3	95.28	0.96	-0.49
	95.32	4	95.30	1.01	-0.43
	AVG	95.32	0.96	-0.42	
37		1	95.07	0.96	-1.22
		2	95.10	0.89	-1.14
	L*	3	95.09	0.86	-1.13
	95.10	4	95.13	0.83	-1.05
		AVG	95.10	0.89	-1.14
38		1	93.52	-0.30	1.17
		2	93.64	-0.31	1.17
	L*	3	93.64	-0.39	1.23
	93.61	4	93.63	-0.31	1.12
		AVG	93.61	-0.33	1.17

Appendix G (continued)

39		1	93.93	-0.14	1.10
		2	93.96	-0.14	1.20
	L*	3	93.99	-0.19	1.23
	93.92	4	93.81	-0.11	1.10
		AVG	93.92	-0.15	1.16
40		1	93.38	-0.22	1.10
		2	93.43	-0.20	1.16
	L*	3	93.33	-0.22	1.06
	93.35	4	93.27	-0.18	1.08
		AVG	93.35	-0.21	1.10
41		1	94.19	-0.26	0.63
		2	94.24	-0.19	0.63
	L*	3	94.05	-0.20	0.72
	94.15	4	94.10	-0.19	0.59
		AVG	94.15	-0.21	0.64
42		1	93.30	0.22	1.46
		2	93.33	0.21	1.48
	L*	3	93.24	0.22	1.19
	93.25	4	93.11	0.44	1.31
		AVG	93.25	0.27	1.36
43		1	93.21	0.06	1.13
		2	93.13	0.17	1.20
	L*	3	93.13	-0.11	1.22
	93.15	4	93.14	0.10	1.11
		AVG	93.15	0.06	1.17
44		1	93.45	0.28	1.55
		2	93.46	0.18	1.62
	L*	3	93.52	0.15	1.50
	93.45	4	93.35	0.21	1.41
		AVG	93.45	0.21	1.52
45		1	97.90	0.96	-1.13
		2	97.96	0.97	-1.13
	L*	3	97.84	0.76	-1.39
	97.85	4	97.70	0.98	-1.53
		AVG	97.85	0.92	-1.30
46		1	98.08	1.20	-1.47
		2	98.11	1.19	-1.50
	L*	3	97.84	1.08	-1.95
	98.01	4	97.99	1.13	-1.72
		AVG	98.01	1.15	-1.66

Appendix G (continued)

47		1	97.97	0.52	0.94
		2	97.97	0.56	0.86
	L*	3	97.63	0.35	0.69
	97.82	4	97.69	0.41	0.61
		AVG	97.82	0.46	0.78
48		1	98.00	0.85	0.45
		2	98.00	0.83	0.36
	L*	3	97.70	0.60	-0.02
	97.87	4	97.79	0.68	0.08
		AVG	97.87	0.74	0.22
49		1	98.14	0.30	0.66
		2	98.21	0.26	0.74
	L*	3	98.16	0.11	0.55
	98.15	4	98.09	0.24	0.54
		AVG	98.15	0.23	0.62
50		1	97.99	1.29	-1.44
		2	97.74	1.42	-1.41
	L*	3	96.76	1.50	-2.19
	97.47	4	97.40	1.47	-1.49
		AVG	97.47	1.42	-1.63
51		1	95.47	1.32	1.47
		2	95.47	1.30	1.44
	L*	3	95.60	1.19	1.58
	95.49	4	95.41	1.36	1.01
		AVG	95.49	1.29	1.38
52		1	95.75	1.15	1.21
		2	95.78	1.15	1.22
	L*	3	95.27	0.98	0.64
	95.63	4	95.70	1.00	1.48
		AVG	95.63	1.07	1.14
53		1	95.01	1.55	-0.68
		2	94.99	1.45	-0.63
	L*	3	94.93	1.51	-0.59
	94.95	4	94.88	1.46	-0.70
		AVG	94.95	1.49	-0.65
54		1	96.26	-0.51	2.26
		2	96.29	-0.61	2.33
	L*	3	96.20	-0.57	2.16
	96.26	4	96.30	-0.56	2.19
		AVG	96.26	-0.56	2.24

Appendix G (continued)

55		1	96.64	0.72	1.97
		2	96.55	0.71	2.02
	L*	3	96.42	0.41	2.00
	96.54	4	96.53	0.73	2.05
		AVG	96.54	0.64	2.01
56		1	95.51	1.62	1.28
		2	95.44	1.64	1.11
	L*	3	95.37	1.48	1.01
	95.45	4	95.47	1.55	1.18
		AVG	95.45	1.57	1.15
57		1	94.94	0.20	-0.09
		2	95.11	0.05	0.02
	L*	3	94.78	0.18	-0.06
	94.95	4	94.95	0.15	-0.13
		AVG	94.95	0.15	-0.07
58		1	94.14	-0.23	-0.15
		2	94.22	-0.34	-0.06
	L*	3	94.27	-0.35	-0.12
	94.20	4	94.18	-0.27	-0.13
		AVG	94.20	-0.30	-0.12
59		1	97.56	0.22	1.70
		2	97.59	0.22	1.69
	L*	3	97.54	0.25	1.61
	97.55	4	97.51	0.29	1.56
		AVG	97.55	0.25	1.64
60		1	97.15	0.87	0.98
		2	97.09	0.86	1.12
	L*	3	96.88	0.88	0.80
	97.03	4	97.01	0.83	0.76
		AVG	97.03	0.86	0.92
61		1	98.11	-0.69	3.07
		2	97.78	-0.68	2.88
	L*	3	97.44	-0.72	2.38
	97.70	4	97.47	-0.68	2.45
		AVG	97.70	-0.69	2.70
62		1	98.28	1.39	-2.76
		2	97.98	1.41	-3.02
	L*	3	97.70	1.39	-3.41
	97.90	4	97.64	1.35	-3.41
		AVG	97.90	1.39	-3.15

Appendix G (continued)

63		1	96.21	0.49	-0.65
		2	96.18	0.46	-0.49
	L*	3	96.14	0.43	-0.85
	96.17	4	96.16	0.49	-0.48
		AVG	96.17	0.47	-0.62
64		1	92.85	0.04	0.82
		2	92.94	-0.04	0.89
	L*	3	92.80	0.05	0.85
	92.87	4	92.88	0.03	0.89
		AVG	92.87	0.02	0.86
65		1	96.99	1.10	-2.34
		2	97.02	1.08	-2.33
	L*	3	96.73	1.09	-2.55
	96.94	4	97.00	1.11	-2.45
		AVG	96.94	1.10	-2.42
66		1	92.37	-0.40	2.04
		2	92.34	-0.33	2.07
	L*	3	92.28	-0.41	2.01
	92.32	4	92.28	-0.36	2.06
		AVG	92.32	-0.38	2.05
67		1	93.16	0.21	1.82
		2	93.16	0.17	1.96
	L*	3	93.28	0.10	1.88
	93.21	4	93.22	0.25	1.73
		AVG	93.21	0.18	1.85
68		1	97.66	1.38	-2.67
		2	97.66	1.27	-2.60
	L*	3	97.00	1.39	-3.12
	97.41	4	97.33	1.38	-2.89
		AVG	97.41	1.36	-2.82
69		1	96.54	-0.85	5.65
		2	96.57	-0.85	5.62
	L*	3	96.44	-0.91	5.38
	96.27	4	95.51	-0.87	5.49
		AVG	96.27	-0.87	5.54
70		1	96.33	-0.20	4.99
		2	96.28	-0.17	4.97
	L*	3	95.98	-0.30	4.41
	96.22	4	96.28	-0.34	4.91
		AVG	96.22	-0.25	4.82

Appendix G (continued)

71	1	96.87	1.33	-0.99
	2	96.90	1.23	-0.91
	L*	3	96.62	1.19
	96.82	4	96.88	1.32
	AVG	96.82	1.27	-1.08
72	1	96.95	1.37	-1.30
	2	96.91	1.42	-1.34
	L*	3	96.68	1.27
	96.86	4	96.90	1.40
	AVG	96.86	1.37	-1.39
73	1	96.49	-0.69	5.99
	2	96.60	-0.75	5.92
	L*	3	95.61	-0.74
	96.29	4	96.47	-0.67
	AVG	96.29	-0.71	5.70
74	1	96.79	-0.92	6.92
	2	96.80	-0.92	7.02
	L*	3	96.26	-1.03
	96.64	4	96.69	-0.94
	AVG	96.64	-0.95	6.71
75	1	96.65	-0.41	2.87
	2	96.74	-0.44	2.94
	L*	3	96.26	-0.50
	96.45	4	96.16	-0.36
	AVG	96.45	-0.43	2.68
76	1	96.56	-0.26	3.60
	2	96.49	-0.30	3.51
	L*	3	95.92	-0.42
	96.33	4	96.34	-0.31
	AVG	96.33	-0.32	3.35
77	1	94.64	0.50	3.32
	2	94.75	0.42	3.45
	L*	3	94.75	0.25
	94.71	4	94.69	0.38
	AVG	94.71	0.39	3.33
78	1	94.51	0.10	3.48
	2	94.55	0.07	3.49
	L*	3	94.51	-0.03
	94.51	4	94.46	0.05
	AVG	94.51	0.05	3.44

Appendix G (continued)

79		1	94.31	0.14	3.04
		2	94.38	0.12	3.12
	L*	3	94.33	0.06	2.96
	94.32	4	94.24	0.19	3.04
		AVG	94.32	0.13	3.04
80		1	96.42	1.05	1.30
		2	96.56	1.01	1.31
	L*	3	96.47	0.89	1.20
	96.48	4	96.46	1.04	1.22
		AVG	96.48	1.00	1.26
81		1	94.40	1.07	1.27
		2	94.36	1.13	1.22
	L*	3	94.38	0.92	1.23
	94.37	4	94.34	1.07	1.20
		AVG	94.37	1.05	1.23
82		1	92.18	-0.74	3.87
		2	92.21	-0.73	3.99
	L*	3	92.24	-0.81	3.73
	92.24	4	92.33	-0.77	3.86
		AVG	92.24	-0.76	3.86
83		1	95.38	1.02	1.45
		2	95.36	0.93	1.41
	L*	3	95.31	0.98	1.25
	95.30	4	95.13	0.99	1.25
		AVG	95.30	0.98	1.34
84		1	93.62	1.50	0.18
		2	93.58	1.52	0.26
	L*	3	93.58	1.50	0.06
	93.58	4	93.54	1.49	0.51
		AVG	93.58	1.50	0.25
85		1	96.62	1.19	0.50
		2	96.60	1.13	0.58
	L*	3	96.39	0.96	0.24
	96.56	4	96.62	1.10	0.43
		AVG	96.56	1.10	0.44
86		1	96.35	-0.48	5.28
		2	96.01	-0.49	5.06
	L*	3	95.97	-0.58	4.70
	96.09	4	96.01	-0.54	4.85
		AVG	96.09	-0.52	4.97

Appendix G (continued)

87		1	92.17	-0.59	2.45
		2	92.23	-0.52	2.53
	L*	3	92.20	-0.62	2.50
	92.21	4	92.25	-0.55	2.55
		AVG	92.21	-0.57	2.51
88		1	94.75	0.78	0.46
		2	94.75	0.77	0.48
	L*	3	94.86	0.65	0.36
	94.78	4	94.75	0.79	0.43
		AVG	94.78	0.75	0.43
89		1	93.76	0.65	1.10
		2	93.77	0.63	1.06
	L*	3	93.74	0.60	0.90
	93.72	4	93.62	0.65	0.91
		AVG	93.72	0.63	0.99
90		1	97.76	1.53	-1.21
		2	97.74	1.51	-1.25
	L*	3	97.60	1.42	-1.59
	97.73	4	97.82	1.52	-1.38
		AVG	97.73	1.50	-1.36
91		1	93.39	0.55	0.63
		2	93.38	0.55	0.68
	L*	3	93.26	0.33	0.44
	93.35	4	93.35	0.48	0.53
		AVG	93.35	0.48	0.57
92		1	94.47	0.39	0.70
		2	94.48	0.41	0.71
	L*	3	94.32	0.35	0.51
	94.40	4	94.32	0.37	0.58
		AVG	94.40	0.38	0.63
93		1	95.84	0.10	4.60
		2	95.82	0.09	4.70
	L*	3	95.76	-0.03	4.21
	95.81	4	95.80	0.08	4.58
		AVG	95.81	0.06	4.52
94		1	96.19	1.67	-1.84
		2	96.19	1.65	-1.63
	L*	3	96.14	1.50	-1.84
	96.18	4	96.19	1.65	-2.09
		AVG	96.18	1.62	-1.85

Appendix G (continued)

95		1	94.59	0.74	-1.09
		2	94.62	0.74	-1.03
	L*	3	94.40	0.77	-1.30
	94.51	4	94.41	0.67	-1.02
		AVG	94.51	0.73	-1.11
96		1	94.44	1.49	-0.12
		2	94.47	1.51	-0.12
	L*	3	94.57	1.32	-0.01
	94.49	4	94.47	1.55	-0.27
		AVG	94.49	1.47	-0.13
97		1	92.71	0.69	1.37
		2	92.74	0.71	1.24
	L*	3	92.73	0.66	1.35
	92.72	4	92.70	0.71	1.36
		AVG	92.72	0.69	1.33
98		1	94.17	-0.28	2.29
		2	94.15	-0.30	2.32
	L*	3	94.30	-0.35	2.26
	94.18	4	94.08	-0.22	2.16
		AVG	94.18	-0.29	2.26
99		1	96.02	0.76	1.38
		2	96.01	0.75	1.33
	L*	3	95.84	0.73	1.02
	95.93	4	95.85	0.68	1.18
		AVG	95.93	0.73	1.23
100		1	97.29	1.70	-0.84
		2	97.31	1.74	-0.69
	L*	3	97.04	1.40	-1.13
	97.21	4	97.19	1.61	-0.92
		AVG	97.21	1.61	-0.90
101		1	95.83	0.94	-0.68
		2	95.82	0.91	-0.65
	L*	3	95.93	0.85	-0.62
	95.88	4	95.92	0.85	-0.69
		AVG	95.88	0.89	-0.66
102		1	93.95	-0.71	3.31
		2	93.98	-0.65	3.20
	L*	3	93.91	-0.74	3.21
	93.94	4	93.91	-0.67	3.28
		AVG	93.94	-0.69	3.25

Appendix G (continued)

103	1	95.20	1.65	-1.36
	2	95.19	1.65	-1.33
	L*	3	95.21	1.42
	95.20	4	95.19	1.61
	AVG	95.20	1.58	-1.42
104	1	95.76	1.09	-0.62
	2	95.83	1.11	-0.61
	L*	3	95.75	1.02
	95.76	4	95.68	1.10
	AVG	95.76	1.08	-0.66
105	1	96.07	0.72	-0.68
	2	95.83	0.77	-0.70
	L*	3	95.88	0.66
	95.88	4	95.73	0.76
	AVG	95.88	0.73	-0.68
106	1	95.11	1.38	-1.44
	2	94.88	1.44	-1.56
	L*	3	94.94	1.50
	95.06	4	95.30	1.36
	AVG	95.06	1.42	-1.47
107	1	96.19	1.03	-0.81
	2	96.28	1.00	-0.79
	L*	3	96.13	0.86
	96.21	4	96.24	1.01
	AVG	96.21	0.98	-0.82
108	1	95.83	0.37	2.24
	2	95.94	0.30	2.25
	L*	3	95.79	0.24
	95.87	4	95.90	0.31
	AVG	95.87	0.31	2.20
109	1	94.95	0.30	2.34
	2	94.92	0.34	2.33
	L*	3	94.91	0.29
	94.85	4	94.62	0.42
	AVG	94.85	0.34	2.31
110	1	94.00	0.97	-2.67
	2	93.93	1.05	-3.04
	L*	3	94.01	1.00
	94.00	4	94.04	0.98
	AVG	94.00	1.00	-2.84

Appendix G (continued)

111	1	92.79	-0.02	3.34
	2	92.77	0.00	3.35
L*	3	92.81	-0.13	3.32
92.79	4	92.78	-0.11	3.35
	AVG	92.79	-0.07	3.34
112	1	93.22	0.08	1.55
	2	93.32	0.03	1.52
L*	3	93.32	0.02	1.54
93.30	4	93.33	0.03	1.56
	AVG	93.30	0.04	1.54
113	1	94.70	1.56	-1.60
	2	94.52	1.61	-1.60
L*	3	94.59	1.46	-1.70
94.64	4	94.74	1.51	-1.61
	AVG	94.64	1.54	-1.63
114	1	95.97	1.26	2.11
	2	95.96	1.24	2.00
L*	3	95.71	1.16	1.78
95.94	4	96.10	1.19	2.10
	AVG	95.94	1.21	2.00
115	1	96.37	0.78	1.16
	2	96.08	0.64	1.28
L*	3	96.36	0.64	1.52
96.30	4	96.39	0.71	1.65
	AVG	96.30	0.69	1.40
116	1	96.11	0.40	-0.50
	2	96.23	0.31	-0.50
L*	3	96.09	0.35	-0.62
96.13	4	96.07	0.37	-0.59
	AVG	96.13	0.36	-0.55
117	1	97.16	0.98	0.79
	2	97.19	0.93	0.67
L*	3	97.05	0.76	0.25
97.09	4	96.96	0.88	0.41
	AVG	97.09	0.89	0.53
118	1	93.47	-0.77	2.77
	2	93.48	-0.77	2.73
L*	3	93.41	-0.81	2.67
93.46	4	93.46	-0.76	2.71
	AVG	93.46	-0.78	2.72

Appendix G (continued)

119		1	93.56	-0.94	3.46
		2	93.64	-1.07	3.48
	L*	3	93.72	-1.08	3.42
	93.61	4	93.53	-0.98	3.33
	AVG		93.61	-1.02	3.42
120		1	93.30	-1.04	3.20
		2	93.34	-1.05	3.18
	L*	3	93.29	-1.12	3.00
	93.32	4	93.36	-1.06	3.15
	AVG		93.32	-1.07	3.13
121		1	94.91	0.60	-0.80
		2	94.90	0.68	-0.96
	L*	3	94.87	0.52	-0.95
	94.92	4	94.98	0.62	-1.00
	AVG		94.92	0.61	-0.93
122		1	95.99	0.67	-0.46
		2	95.93	0.70	-0.52
	L*	3	95.86	0.64	-0.90
	95.90	4	95.83	0.68	-0.66
	AVG		95.90	0.67	-0.64
123		1	94.78	0.72	1.02
		2	94.70	0.74	1.00
	L*	3	94.69	0.67	0.79
	94.74	4	94.78	0.61	1.20
	AVG		94.74	0.69	1.00
124		1	96.61	1.71	-2.20
		2	96.52	1.74	-2.05
	L*	3	96.34	1.57	-2.39
	96.53	4	96.64	1.75	-2.11
	AVG		96.53	1.69	-2.19
125		1	93.52	0.34	0.06
		2	93.52	0.41	-0.01
	L*	3	93.47	0.34	-0.15
	93.50	4	93.48	0.37	0.00
	AVG		93.50	0.37	-0.03
126		1	92.86	0.14	3.33
		2	92.84	0.17	3.32
	L*	3	92.78	0.14	3.16
	92.82	4	92.79	0.22	3.29
	AVG		92.82	0.17	3.28

Appendix G (continued)

127	1	97.90	1.32	-2.97
	2	97.95	1.31	-2.91
L*	3	97.99	1.38	-2.99
97.98	4	98.07	1.35	-2.82
	AVG	97.98	1.34	-2.92
128	1	94.02	1.18	0.32
	2	94.05	1.22	0.41
L*	3	94.01	1.17	0.24
94.01	4	93.96	1.20	0.32
	AVG	94.01	1.19	0.32

Appendix H

X-Rite 948 w\Illum. D_{65} and calc. WI from Y, x, y vs. Visual Ranking

Appendix H

X-Rite 948 w\Illum. D₆₅ and calc. WI from Y, x, y vs. Visual Ranking

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CIE WI= @ROUND((D20)+(800*(0.3127-(E20)))+(
          (1700*(0.3290-(F20))),2)
AVG Y = @ROUND((@SUM(D16..D19)/4),2)
AVG x = @ROUND((@SUM(E16..E19)/4),4)
AVG y = @ROUND((@SUM(F16..F19)/4),4)

```

GRADE CODE	SAMPLE	Y ILL D65 X-RITE	X ILL D65 X-RITE	Y ILL D65 X-RITE
=====				
1	1	93.10	0.3136	0.3274
	2	93.04	0.3135	0.3274
	CIE WI	92.72	0.3129	0.3269
	95.61	92.92	0.3127	0.3269
	AVG	92.95	0.3132	0.3272
2	1	91.81	0.3116	0.3246
	2	91.61	0.3116	0.3245
	CIE WI	91.68	0.3113	0.3243
	100.54	90.63	0.3107	0.3237
	AVG	91.43	0.3113	0.3243
3	1	91.29	0.3225	0.3403
	2	91.18	0.3225	0.3403
	CIE WI	90.50	0.3214	0.3396
	64.45	91.37	0.3225	0.3405
	AVG	91.09	0.3222	0.3402
4	1	91.58	0.3206	0.3384
	2	91.80	0.3206	0.3385
	CIE WI	91.59	0.3203	0.3384
	69.30	91.79	0.3206	0.3385
	AVG	91.69	0.3205	0.3385
5	1	92.52	0.3182	0.3335
	2	92.64	0.3180	0.3333
	CIE WI	91.38	0.3165	0.3323
	81.09	92.70	0.3184	0.3336
	AVG	92.31	0.3178	0.3332
6	1	91.26	0.3163	0.3310
	2	90.67	0.3162	0.3307
	CIE WI	89.97	0.3149	0.3300
	85.50	91.91	0.3161	0.3312
	AVG	90.95	0.3159	0.3307

Appendix H (continued)

7		1	94.06	0.3155	0.3309
		2	94.20	0.3157	0.3313
	CIE WI	3	93.53	0.3150	0.3306
	88.55	4	93.66	0.3150	0.3307
		AVG	93.86	0.3153	0.3309
8		1	93.35	0.3156	0.3313
		2	93.80	0.3160	0.3316
	CIE WI	3	93.12	0.3147	0.3305
	87.70	4	93.44	0.3154	0.3311
		AVG	93.43	0.3154	0.3311
9		1	94.16	0.3155	0.3314
		2	94.17	0.3157	0.3315
	CIE WI	3	93.83	0.3150	0.3311
	87.98	4	94.02	0.3152	0.3312
		AVG	94.05	0.3154	0.3313
10		1	93.51	0.3160	0.3315
		2	93.47	0.3159	0.3313
	CIE WI	3	93.07	0.3155	0.3313
	86.82	4	93.45	0.3156	0.3313
		AVG	93.38	0.3158	0.3314
11		1	92.37	0.3162	0.3311
		2	92.30	0.3163	0.3314
	CIE WI	3	89.32	0.3144	0.3292
	85.88	4	91.99	0.3166	0.3313
		AVG	91.50	0.3159	0.3308
12		1	92.40	0.3151	0.3297
		2	92.63	0.3154	0.3301
	CIE WI	3	92.03	0.3146	0.3297
	89.15	4	92.03	0.3145	0.3295
		AVG	92.27	0.3149	0.3298
13		1	89.36	0.3211	0.3372
		2	89.13	0.3212	0.3371
	CIE WI	3	88.03	0.3199	0.3360
	69.14	4	88.69	0.3206	0.3367
		AVG	88.80	0.3207	0.3368
14		1	90.03	0.3223	0.3376
		2	89.93	0.3225	0.3379
	CIE WI	3	89.80	0.3212	0.3372
	67.90	4	90.38	0.3222	0.3377
		AVG	90.04	0.3221	0.3376

Appendix H (continued)

15	1	93.21	0.3161	0.3318
	2	93.52	0.3160	0.3316
CIE WI	3	92.08	0.3155	0.3309
86.35	4	93.16	0.3158	0.3312
	AVG	92.99	0.3159	0.3314
16	1	95.18	0.3158	0.3321
	2	95.26	0.3159	0.3322
CIE WI	3	95.23	0.3157	0.3322
87.32	4	95.27	0.3158	0.3322
	AVG	95.24	0.3158	0.3322
17	1	90.48	0.3223	0.3407
	2	90.55	0.3224	0.3407
CIE WI	3	89.19	0.3210	0.3396
63.42	4	89.73	0.3217	0.3401
	AVG	89.99	0.3219	0.3403
18	1	94.40	0.3160	0.3323
	2	94.23	0.3161	0.3325
CIE WI	3	94.41	0.3160	0.3326
85.75	4	94.30	0.3160	0.3324
	AVG	94.34	0.3160	0.3325
19	1	94.67	0.3161	0.3320
	2	93.30	0.3150	0.3309
CIE WI	3	94.10	0.3155	0.3316
87.53	4	94.00	0.3153	0.3314
	AVG	94.02	0.3155	0.3315
20	1	93.59	0.3233	0.3420
	2	93.57	0.3233	0.3420
CIE WI	3	92.72	0.3221	0.3412
63.38	4	93.62	0.3234	0.3421
	AVG	93.38	0.3230	0.3418
21	1	92.79	0.3245	0.3427
	2	92.77	0.3245	0.3427
CIE WI	3	92.28	0.3239	0.3426
60.17	4	92.12	0.3238	0.3424
	AVG	92.49	0.3242	0.3426
22	1	87.81	0.3165	0.3308
	2	88.02	0.3160	0.3303
CIE WI	3	88.02	0.3158	0.3302
83.72	4	87.69	0.3158	0.3302
	AVG	87.89	0.3160	0.3299

Appendix H (continued)

23	1	87.40	0.3157	0.3296
	2	87.27	0.3158	0.3295
CIE WI	3	87.53	0.3155	0.3294
84.33	4	87.12	0.3155	0.3292
	AVG	87.33	0.3156	0.3294
24	1	86.35	0.3158	0.3303
	2	86.83	0.3157	0.3302
CIE WI	3	86.90	0.3158	0.3305
82.14	4	86.73	0.3158	0.3303
	AVG	86.83	0.3158	0.3303
25	1	87.74	0.3156	0.3288
	2	87.74	0.3154	0.3285
CIE WI	3	88.05	0.3154	0.3287
86.38	4	87.90	0.3153	0.3285
	AVG	87.86	0.3154	0.3286
26	1	87.09	0.3158	0.3301
	2	87.32	0.3157	0.3301
CIE WI	3	87.23	0.3156	0.3299
83.12	4	87.23	0.3155	0.3299
	AVG	87.22	0.3157	0.3300
27	1	88.24	0.3157	0.3297
	2	88.30	0.3159	0.3301
CIE WI	3	88.36	0.3156	0.3301
84.22	4	87.71	0.3157	0.3297
	AVG	88.15	0.3157	0.3299
28	1	87.73	0.3151	0.3289
	2	87.94	0.3151	0.3291
CIE WI	3	87.76	0.3150	0.3290
86.06	4	87.80	0.3150	0.3287
	AVG	87.81	0.3151	0.3289
29	1	87.13	0.3155	0.3302
	2	87.27	0.3157	0.3306
CIE WI	3	87.14	0.3153	0.3302
82.91	4	86.89	0.3152	0.3299
	AVG	87.11	0.3154	0.3302
30	1	87.34	0.3120	0.3270
	2	87.40	0.3119	0.3268
CIE WI	3	86.56	0.3114	0.3264
91.66	4	87.50	0.3118	0.3268
	AVG	87.20	0.3118	0.3268

Appendix H (continued)

31	1	86.59	0.3115	0.3254
	2	86.92	0.3111	0.3248
CIE WI	3	86.68	0.3111	0.3247
94.66	4	86.76	0.3113	0.3250
	AVG	86.74	0.3113	0.3250
32	1	87.41	0.3129	0.3276
	2	87.51	0.3129	0.3278
CIE WI	3	87.66	0.3125	0.3274
89.68	4	87.60	0.3129	0.3279
	AVG	87.55	0.3128	0.3277
33	1	87.61	0.3125	0.3271
	2	87.21	0.3125	0.3269
CIE WI	3	87.60	0.3124	0.3270
91.02	4	87.40	0.3124	0.3269
	AVG	87.46	0.3125	0.3270
34	1	88.49	0.3118	0.3272
	2	88.58	0.3117	0.3271
CIE WI	3	88.28	0.3116	0.3270
92.48	4	88.43	0.3116	0.3270
	AVG	88.45	0.3117	0.3271
35	1	87.23	0.3123	0.3273
	2	87.14	0.3122	0.3273
CIE WI	3	87.01	0.3122	0.3274
90.19	4	87.21	0.3124	0.3276
	AVG	87.15	0.3123	0.3274
36	1	88.31	0.3133	0.3275
	2	88.60	0.3134	0.3279
CIE WI	3	88.29	0.3132	0.3275
90.28	4	88.32	0.3134	0.3276
	AVG	88.38	0.3133	0.3276
37	1	87.78	0.3119	0.3262
	2	87.86	0.3119	0.3264
CIE WI	3	87.84	0.3119	0.3264
92.91	4	87.93	0.3120	0.3266
	AVG	87.85	0.3119	0.3264
38	1	84.16	0.3144	0.3314
	2	84.43	0.3144	0.3314
CIE WI	3	84.44	0.3144	0.3316
78.92	4	84.42	0.3143	0.3313
	AVG	84.36	0.3144	0.3314

Appendix H (continued)

39	1	85.10	0.3145	0.3312	
	2	85.18	0.3147	0.3314	
	CIE WI	3	85.24	0.3146	0.3314
	79.66	4	84.83	0.3145	0.3311
	AVG	85.09	0.3146	0.3313	
40	1	83.83	0.3144	0.3312	
	2	83.96	0.3145	0.3313	
	CIE WI	3	83.73	0.3143	0.3312
	78.68	4	83.58	0.3144	0.3312
	AVG	83.78	0.3144	0.3312	
41	1	85.71	0.3135	0.3304	
	2	85.84	0.3136	0.3303	
	CIE WI	3	85.39	0.3137	0.3305
	82.51	4	85.51	0.3135	0.3303
	AVG	85.61	0.3136	0.3304	
42	1	83.65	0.3157	0.3316	
	2	83.72	0.3157	0.3317	
	CIE WI	3	83.51	0.3152	0.3311
	77.13	4	83.23	0.3157	0.3312
	AVG	83.53	0.3156	0.3314	
43	1	83.45	0.3148	0.3311	
	2	83.26	0.3151	0.3312	
	CIE WI	3	83.26	0.3148	0.3314
	77.82	4	83.30	0.3149	0.3311
	AVG	83.32	0.3149	0.3312	
44	1	83.99	0.3159	0.3318	
	2	84.02	0.3159	0.3319	
	CIE WI	3	84.16	0.3156	0.3317
	77.00	4	83.77	0.3155	0.3315
	AVG	83.99	0.3157	0.3317	
45	1	94.66	0.3121	0.3264	
	2	94.82	0.3121	0.3264	
	CIE WI	3	94.53	0.3113	0.3261
	100.10	4	94.16	0.3114	0.3257
	AVG	94.54	0.3117	0.3262	
46	1	95.13	0.3118	0.3257	
	2	95.18	0.3117	0.3256	
	CIE WI	3	94.51	0.3108	0.3248
	102.26	4	94.89	0.3113	0.3252
	AVG	94.93	0.3114	0.3253	

Appendix H (continued)

47	1	97.84	0.3150	0.3304
	2	94.85	0.3150	0.3302
CIE WI	3	94.01	0.3144	0.3301
91.57	4	94.15	0.3143	0.3299
	AVG	95.21	0.3147	0.3302
48	1	94.92	0.3146	0.3293
	2	94.92	0.3144	0.3291
CIE WI	3	94.17	0.3135	0.3286
93.65	4	94.38	0.3137	0.3287
	AVG	94.60	0.3141	0.3289
49	1	95.28	0.3143	0.3300
	2	95.43	0.3143	0.3302
CIE WI	3	95.32	0.3138	0.3300
92.47	4	95.14	0.3140	0.3299
	AVG	95.29	0.3141	0.3300
50	1	94.89	0.3120	0.3257
	2	94.27	0.3122	0.3256
CIE WI	3	91.86	0.3109	0.3241
100.79	4	93.43	0.3121	0.3254
	AVG	93.61	0.3118	0.3252
51	1	88.75	0.3171	0.3309
	2	88.74	0.3170	0.3308
CIE WI	3	89.05	0.3171	0.3312
82.53	4	88.59	0.3163	0.3300
	AVG	88.78	0.3169	0.3307
52	1	89.41	0.3164	0.3305
	2	89.47	0.3164	0.3305
CIE WI	3	88.27	0.3152	0.3296
83.93	4	89.29	0.3167	0.3311
	AVG	89.11	0.3162	0.3304
53	1	87.63	0.3136	0.3268
	2	87.60	0.3136	0.3269
CIE WI	3	87.45	0.3137	0.3270
90.70	4	87.34	0.3135	0.3260
	AVG	87.51	0.3136	0.3267
54	1	90.64	0.3160	0.3335
	2	90.72	0.3160	0.3337
CIE WI	3	90.48	0.3157	0.3333
80.43	4	90.73	0.3158	0.3334
	AVG	90.64	0.3159	0.3335

Appendix H (continued)

55	1	91.56	0.3171	0.3322
	2	91.33	0.3172	0.3322
CIE WI	3	91.02	0.3168	0.3324
82.01	4	91.30	0.3173	0.3323
	AVG	91.30	0.3171	0.3323
56	1	88.83	0.3172	0.3303
	2	88.67	0.3169	0.3300
CIE WI	3	88.51	0.3165	0.3299
83.33	4	88.73	0.3169	0.3302
	AVG	88.69	0.3169	0.3301
57	1	87.48	0.3129	0.3287
	2	87.87	0.3128	0.3290
CIE WI	3	87.10	0.3129	0.3288
87.75	4	87.49	0.3127	0.3287
	AVG	87.49	0.3128	0.3288
58	1	85.60	0.3121	0.3289
	2	85.79	0.3122	0.3291
CIE WI	3	85.90	0.3121	0.3290
86.22	4	85.68	0.3121	0.3289
	AVG	85.74	0.3121	0.3290
59	1	93.83	0.3159	0.3320
	2	93.89	0.3159	0.3319
CIE WI	3	93.77	0.3158	0.3318
86.31	4	93.70	0.3158	0.3317
	AVG	93.80	0.3159	0.3319
60	1	92.80	0.3156	0.3302
	2	92.65	0.3158	0.3305
CIE WI	3	92.14	0.3153	0.3299
88.40	4	92.46	0.3151	0.3299
	AVG	92.51	0.3155	0.3301
61	1	95.20	0.3171	0.3350
	2	94.37	0.3168	0.3347
CIE WI	3	93.53	0.3159	0.3338
81.95	4	93.59	0.3160	0.3339
	AVG	94.17	0.3165	0.3344
62	1	95.62	0.3098	0.3232
	2	94.86	0.3094	0.3227
CIE WI	3	94.16	0.3087	0.3220
108.52	4	94.03	0.3087	0.3221
	AVG	94.67	0.3092	0.3225

Appendix H (continued)

63	1	90.51	0.3123	0.3275
	2	90.45	0.3125	0.3278
	CIE WI	3	90.35	0.3118
	93.13	4	90.41	0.3125
	AVG	90.43	0.3123	0.3276
64	1	82.63	0.3143	0.3306
	2	82.83	0.3143	0.3307
	CIE WI	3	82.52	0.3143
	78.50	4	82.70	0.3144
	AVG	82.67	0.3143	0.3307
65	1	92.43	0.3101	0.3241
	2	92.48	0.3101	0.3241
	CIE WI	3	91.77	0.3098
	102.94	4	92.44	0.3100
	AVG	92.28	0.3100	0.3240
66	1	81.55	0.3158	0.3332
	2	81.46	0.3160	0.3332
	CIE WI	3	81.34	0.3158
	71.72	4	81.34	0.3160
	AVG	81.42	0.3159	0.3332
67	1	83.34	0.3163	0.3323
	2	83.33	0.3165	0.3326
	CIE WI	3	83.60	0.3162
	74.78	4	83.48	0.3162
	AVG	83.44	0.3163	0.3324
68	1	94.06	0.3100	0.3234
	2	94.08	0.3099	0.3236
	CIE WI	3	92.45	0.3092
	105.89	4	93.25	0.3096
	AVG	93.46	0.3097	0.3231
69	1	91.31	0.3214	0.3399
	2	91.39	0.3213	0.3398
	CIE WI	3	91.07	0.3209
	66.26	4	91.24	0.3211
	AVG	91.25	0.3212	0.3397
70	1	90.79	0.3211	0.3383
	2	90.69	0.3212	0.3382
	CIE WI	3	89.96	0.3200
	68.76	4	90.70	0.3208
	AVG	90.54	0.3208	0.3380

Appendix H (continued)

71	1	92.12	0.3128	0.3264
	2	92.19	0.3128	0.3266
CIE WI	3	91.51	0.3119	0.3257
96.66	4	92.14	0.3128	0.3264
	AVG	91.99	0.3126	0.3263
72	1	92.33	0.3123	0.3258
	2	92.22	0.3123	0.3257
CIE WI	3	91.65	0.3116	0.3252
98.11	4	92.21	0.3124	0.3259
	AVG	92.10	0.3122	0.3257
73	1	91.20	0.3222	0.3404
	2	91.47	0.3220	0.3403
CIE WI	3	89.06	0.3204	0.3386
64.99	4	91.15	0.3221	0.3403
	AVG	90.72	0.3217	0.3399
74	1	91.94	0.3235	0.3423
	2	91.94	0.3236	0.3424
CIE WI	3	90.63	0.3220	0.3410
61.30	4	91.67	0.3231	0.3420
	AVG	91.55	0.3231	0.3419
75	1	91.57	0.3172	0.3345
	2	91.80	0.3172	0.3347
CIE WI	3	90.64	0.3162	0.3337
78.98	4	90.38	0.3166	0.3338
	AVG	91.10	0.3168	0.3342
76	1	91.37	0.3186	0.3358
	2	91.18	0.3184	0.3356
CIE WI	3	89.81	0.3171	0.3345
75.60	4	90.84	0.3183	0.3355
	AVG	90.80	0.3181	0.3354
77	1	86.76	0.3193	0.3348
	2	87.02	0.3194	0.3351
CIE WI	3	87.03	0.3187	0.3348
71.70	4	86.89	0.3192	0.3350
	AVG	86.93	0.3192	0.3349
78	1	86.46	0.3190	0.3354
	2	86.57	0.3190	0.3355
CIE WI	3	86.47	0.3186	0.3353
70.62	4	86.33	0.3189	0.3353
	AVG	86.46	0.3189	0.3354

Appendix H (continued)

79	1	85.99	0.3183	0.3346
	2	86.16	0.3184	0.3347
	CIE WI	3	86.03	0.3181
	72.01	4	85.84	0.3184
	AVG	86.01	0.3183	0.3346
80	1	91.04	0.3164	0.3307
	2	91.35	0.3164	0.3308
	CIE WI	3	91.16	0.3160
	85.40	4	91.13	0.3162
	AVG	91.17	0.3163	0.3307
81	1	86.22	0.3164	0.3307
	2	86.11	0.3164	0.3306
	CIE WI	3	86.16	0.3162
	80.37	4	86.07	0.3163
	AVG	86.14	0.3163	0.3307
82	1	81.10	0.3187	0.3369
	2	81.17	0.3189	0.3371
	CIE WI	3	81.24	0.3183
	63.09	4	81.45	0.3186
	AVG	81.24	0.3186	0.3369
83	1	88.51	0.3166	0.3310
	2	88.48	0.3164	0.3310
	CIE WI	3	88.37	0.3162
	82.13	4	87.92	0.3163
	AVG	88.32	0.3164	0.3309
84	1	84.38	0.3151	0.3284
	2	84.29	0.3153	0.3285
	CIE WI	3	84.30	0.3149
	83.06	4	84.20	0.3157
	AVG	84.29	0.3153	0.3285
85	1	91.51	0.3152	0.3292
	2	91.47	0.3152	0.3293
	CIE WI	3	90.96	0.3144
	89.44	4	91.52	0.3149
	AVG	91.37	0.3149	0.3291
86	1	90.85	0.3213	0.3390
	2	90.04	0.3209	0.3386
	CIE WI	3	89.92	0.3202
	67.66	4	90.04	0.3204
	AVG	90.21	0.3207	0.3385

Appendix H (continued)

87	1	81.09	0.3163	0.3341
	2	81.23	0.3166	0.3342
CIE WI	3	81.15	0.3164	0.3342
69.31	4	81.27	0.3166	0.3342
	AVG	81.19	0.3165	0.3342
88	1	87.03	0.3146	0.3294
	2	87.02	0.3146	0.3294
CIE WI	3	87.30	0.3143	0.3293
84.97	4	87.02	0.3146	0.3293
	AVG	87.09	0.3145	0.3294
89	1	84.72	0.3156	0.3306
	2	84.74	0.3155	0.3306
CIE WI	3	84.66	0.3151	0.3303
79.92	4	84.38	0.3152	0.3303
	AVG	84.63	0.3154	0.3305
90	1	94.32	0.3126	0.3259
	2	94.26	0.3126	0.3258
CIE WI	3	93.93	0.3119	0.3253
100.09	4	94.45	0.3124	0.3256
	AVG	94.24	0.3124	0.3257
91	1	83.86	0.3146	0.3298
	2	83.85	0.3147	0.3299
CIE WI	3	83.55	0.3140	0.3296
81.04	4	83.77	0.3143	0.3297
	AVG	83.76	0.3144	0.3298
92	1	86.38	0.3145	0.3301
	2	86.38	0.3145	0.3301
CIE WI	3	86.02	0.3141	0.3298
83.14	4	86.01	0.3143	0.3299
	AVG	86.20	0.3144	0.3300
93	1	89.61	0.3209	0.3374
	2	89.56	0.3211	0.3376
CIE WI	3	89.44	0.3200	0.3368
69.03	4	89.53	0.3208	0.3374
	AVG	89.54	0.3207	0.3373
94	1	90.47	0.3118	0.3246
	2	90.46	0.3121	0.3250
CIE WI	3	90.34	0.3115	0.3247
98.72	4	90.47	0.3113	0.3242
	AVG	90.44	0.3117	0.3246

Appendix H (continued)

95	1	86.66	0.3118	0.3265
	2	86.72	0.3119	0.3267
CIE WI	3	86.20	0.3115	0.3261
91.43	4	86.24	0.3119	0.3267
	AVG	86.46	0.3118	0.3265
96	1	86.31	0.3146	0.3279
	2	86.37	0.3146	0.3278
CIE WI	3	86.60	0.3145	0.3282
86.84	4	86.37	0.3143	0.3275
	AVG	86.41	0.3145	0.3279
97	1	82.31	0.3161	0.3311
	2	82.39	0.3159	0.3309
CIE WI	3	82.35	0.3161	0.3311
76.04	4	82.28	0.3161	0.3311
	AVG	82.33	0.3161	0.3311
98	1	85.67	0.3164	0.3335
	2	85.62	0.3165	0.3336
CIE WI	3	85.97	0.3163	0.3334
75.24	4	85.46	0.3163	0.3332
	AVG	85.68	0.3164	0.3334
99	1	90.07	0.3161	0.3311
	2	90.04	0.3161	0.3310
CIE WI	3	89.63	0.3155	0.3304
84.23	4	89.64	0.3157	0.3308
	AVG	89.85	0.3159	0.3308
100	1	93.14	0.3135	0.3264
	2	93.20	0.3139	0.3267
CIE WI	3	92.53	0.3126	0.3261
96.89	4	92.91	0.3133	0.3263
	AVG	92.95	0.3133	0.3264
101	1	89.59	0.3128	0.3272
	2	89.57	0.3128	0.3272
CIE WI	3	89.83	0.3128	0.3273
92.68	4	89.82	0.3126	0.3272
	AVG	89.70	0.3128	0.3272
102	1	85.15	0.3176	0.3357
	2	85.22	0.3175	0.3354
CIE WI	3	85.07	0.3174	0.3355
69.99	4	85.06	0.3177	0.3356
	AVG	85.13	0.3176	0.3356

Appendix H (continued)

103	1	88.10	0.3126	0.3255
	2	88.06	0.3126	0.3255
CIE WI	3	88.11	0.3120	0.3253
94.45	4	88.07	0.3124	0.3253
	AVG	88.09	0.3124	0.3254
104	1	89.42	0.3131	0.3272
	2	89.60	0.3131	0.3272
CIE WI	3	89.41	0.3124	0.3270
92.49	4	89.25	0.3131	0.3271
	AVG	89.42	0.3129	0.3271
105	1	90.16	0.3125	0.3273
	2	89.60	0.3125	0.3273
CIE WI	3	89.72	0.3126	0.3275
92.76	4	89.37	0.3124	0.3271
	AVG	89.71	0.3125	0.3273
106	1	87.87	0.3120	0.3255
	2	87.34	0.3119	0.3252
CIE WI	3	87.48	0.3121	0.3253
94.43	4	88.32	0.3121	0.3256
	AVG	87.75	0.3120	0.3254
107	1	90.48	0.3127	0.3269
	2	90.69	0.3127	0.3269
CIE WI	3	90.33	0.3123	0.3268
94.17	4	90.59	0.3128	0.3270
	AVG	90.52	0.3126	0.3269
108	1	89.59	0.3171	0.3329
	2	89.86	0.3171	0.3330
CIE WI	3	89.51	0.3167	0.3326
79.62	4	89.78	0.3171	0.3329
	AVG	89.69	0.3170	0.3329
109	1	87.49	0.3173	0.3332
	2	87.42	0.3173	0.3331
CIE WI	3	87.41	0.3172	0.3331
76.61	4	86.72	0.3173	0.3330
	AVG	87.26	0.3173	0.3331
110	1	85.27	0.3093	0.3234
	2	85.10	0.3088	0.3227
CIE WI	3	85.29	0.3091	0.3231
98.16	4	85.35	0.3091	0.3232
	AVG	85.25	0.3091	0.3231

Appendix H (continued)

111	1	82.48	0.3184	0.3353
	2	82.44	0.3188	0.3354
CIE WI	3	82.54	0.3185	0.3354
66.88	4	82.47	0.3186	0.3354
	AVG	82.48	0.3186	0.3354
112	1	83.46	0.3156	0.3319
	2	83.71	0.3155	0.3319
CIE WI	3	83.69	0.3155	0.3319
76.48	4	83.73	0.3155	0.3319
	AVG	83.65	0.3155	0.3319
113	1	86.91	0.3120	0.3251
	2	86.48	0.3121	0.3250
CIE WI	3	86.66	0.3117	0.3249
94.21	4	87.01	0.3119	0.3251
	AVG	86.77	0.3119	0.3250
114	1	89.92	0.3181	0.3321
	2	89.92	0.3179	0.3319
CIE WI	3	89.32	0.3174	0.3315
80.76	4	90.24	0.3180	0.3321
	AVG	89.85	0.3179	0.3319
115	1	90.91	0.3167	0.3315
	2	90.20	0.3158	0.3309
CIE WI	3	90.89	0.3162	0.3314
83.78	4	90.95	0.3166	0.3316
	AVG	90.74	0.3163	0.3314
116	1	90.26	0.3124	0.3278
	2	90.56	0.3123	0.3279
CIE WI	3	90.22	0.3121	0.3277
92.67	4	90.18	0.3122	0.3277
	AVG	90.31	0.3123	0.3278
117	1	92.83	0.3154	0.3298
	2	92.91	0.3151	0.3296
CIE WI	3	92.56	0.3142	0.3290
90.30	4	92.34	0.3146	0.3292
	AVG	92.66	0.3148	0.3294
118	1	84.05	0.3166	0.3347
	2	84.07	0.3165	0.3347
CIE WI	3	83.90	0.3164	0.3346
71.28	4	84.03	0.3165	0.3346
	AVG	84.01	0.3165	0.3347

Appendix H (continued)

119	1	84.26	0.3176	0.3362
	2	84.44	0.3175	0.3363
CIE WI	3	84.63	0.3174	0.3361
68.47	4	84.18	0.3173	0.3359
	AVG	84.38	0.3175	0.3361
120	1	83.64	0.3170	0.3357
	2	83.74	0.3169	0.3357
CIE WI	3	83.64	0.3165	0.3354
69.21	4	83.80	0.3169	0.3357
	AVG	83.71	0.3168	0.3356
121	1	87.41	0.3122	0.3272
	2	87.37	0.3120	0.3268
CIE WI	3	87.32	0.3118	0.3269
91.55	4	87.57	0.3118	0.3268
	AVG	87.42	0.3120	0.3269
122	1	89.99	0.3128	0.3277
	2	89.83	0.3128	0.3276
CIE WI	3	89.67	0.3120	0.3270
92.66	4	89.61	0.3125	0.3274
	AVG	89.78	0.3125	0.3274
123	1	87.10	0.3155	0.3304
	2	86.90	0.3155	0.3304
CIE WI	3	86.87	0.3150	0.3300
82.45	4	87.10	0.3157	0.3308
	AVG	86.99	0.3154	0.3304
124	1	91.49	0.3112	0.3240
	2	91.28	0.3115	0.3242
CIE WI	3	90.84	0.3107	0.3237
100.99	4	91.55	0.3114	0.3241
	AVG	91.29	0.3112	0.3240
125	1	84.16	0.3133	0.3289
	2	84.16	0.3133	0.3287
CIE WI	3	84.05	0.3130	0.3285
84.22	4	84.08	0.3132	0.3288
	AVG	84.11	0.3132	0.3287
126	1	82.65	0.3189	0.3352
	2	82.61	0.3189	0.3352
CIE WI	3	82.46	0.3186	0.3349
67.22	4	82.48	0.3190	0.3351
	AVG	82.55	0.3189	0.3351

Appendix H (continued)

127	1	94.67	0.3094	0.3229
	2	94.80	0.3095	0.3230
CIE WI	3	94.88	0.3094	0.3228
107.62	4	95.10	0.3097	0.3232
	AVG	94.86	0.3095	0.3230
128	1	85.32	0.3149	0.3288
	2	85.39	0.3151	0.3290
CIE WI	3	85.28	0.3148	0.3287
83.88	4	85.19	0.3149	0.3288
	AVG	85.30	0.3149	0.3288

Appendix I

Summary of Minolta CR-200b Results in Visual Rank Order

Appendix I

Summary of Minolta CR-200b Results in Visual Rank Order

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
70	1.98	96.40	70.52	96.28	68.51
82	2.16	92.28	72.94	92.20	72.71
74	2.41	96.73	67.57	96.60	67.74
21	2.56	97.03	69.99	96.98	70.26
120	2.76	93.30	79.86	93.30	79.41
3	2.79	96.65	73.38	96.58	73.20
119	2.80	93.65	78.99	93.55	78.36
102	2.80	93.35	73.67	93.30	72.76
20	2.82	97.60	73.36	97.55	73.25
17	2.90	96.23	72.40	96.28	72.07
111	2.92	92.80	77.64	92.80	77.54
14	3.00	96.08	64.39	96.00	64.09
73	3.02	96.70	73.05	96.55	72.38
87	3.06	92.13	79.50	92.10	79.71
126	3.13	92.83	77.57	92.78	77.80
93	3.22	95.90	71.44	95.90	70.56
79	3.24	94.33	76.04	94.10	75.19
43	3.26	93.00	75.47	93.00	75.39
13	3.28	96.13	66.94	96.05	66.84
69	3.30	96.65	76.08	96.55	75.25
118	3.32	93.58	80.89	93.58	80.84
67	3.33	93.18	75.02	93.05	75.93
66	3.34	92.38	82.71	92.30	82.19
78	3.34	94.55	77.39	94.58	77.41
4	3.35	96.78	76.89	96.93	77.21
98	3.38	94.30	75.62	94.10	76.26
77	3.39	94.88	76.52	94.88	75.56
64	3.43	92.90	79.34	92.80	77.75
109	3.54	94.40	75.08	94.30	74.45
40	3.55	93.10	84.36	93.05	83.65
42	3.58	93.20	77.57	93.13	77.46
86	3.59	96.55	77.46	96.35	76.95
112	3.62	92.93	76.99	92.85	76.71
125	3.65	93.45	76.07	93.43	74.66
44	3.70	93.28	77.77	93.30	77.66
91	3.71	93.38	80.47	93.25	78.78
39	3.76	93.80	83.94	93.78	83.30
38	3.84	93.40	85.57	93.40	84.95
108	3.86	95.35	78.49	95.30	77.41

Appendix I (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
123	3.92	94.68	73.60	94.60	73.29
76	3.95	96.50	84.73	96.30	83.56
97	3.96	92.78	81.69	92.73	81.56
89	3.99	93.68	73.85	93.63	73.51
24	4.01	94.55	75.48	94.45	75.17
41	4.08	93.85	84.89	93.83	85.08
114	4.09	95.58	77.73	95.53	76.34
56	4.21	95.38	78.52	95.38	79.12
128	4.22	93.93	81.02	93.90	78.31
26	4.22	94.78	77.87	94.70	77.79
84	4.23	93.70	82.09	93.53	81.05
75	4.25	96.63	88.56	96.45	87.76
22	4.27	95.10	78.29	95.00	78.27
52	4.29	95.35	81.37	95.43	80.70
81	4.29	94.35	74.47	94.33	74.34
55	4.30	96.53	81.34	96.45	80.26
5	4.31	96.93	78.87	96.95	78.96
27	4.33	95.15	78.79	95.18	78.81
83	4.33	95.40	77.47	95.40	77.10
92	4.37	94.53	82.37	94.43	81.40
23	4.39	94.88	75.57	94.78	75.41
29	4.41	94.70	78.35	94.75	78.00
25	4.48	95.05	77.77	94.93	77.39
58	4.51	94.23	97.14	94.23	95.76
96	4.54	94.45	80.86	94.45	80.80
115	4.55	95.88	84.95	95.80	84.67
88	4.56	94.70	76.82	94.68	76.50
28	4.58	94.85	78.12	94.88	78.16
6	4.59	96.30	79.99	96.40	79.95
8	4.68	97.18	83.71	97.23	83.01
51	4.69	95.28	79.99	95.28	78.45
10	4.79	97.13	84.39	97.10	84.29
60	4.81	96.98	80.74	96.93	79.60
80	4.81	96.38	84.61	96.23	83.62
54	4.83	96.43	91.41	96.40	90.48
99	4.84	96.03	79.32	96.03	79.58
122	4.86	95.75	83.57	95.68	82.91
85	4.87	96.38	77.62	96.40	77.59
9	4.93	97.48	87.53	97.38	86.31
11	4.95	96.93	78.99	97.00	79.01
61	4.96	97.75	91.44	97.85	91.19
53	4.96	95.08	83.40	95.05	82.92
32	4.96	94.80	85.88	94.80	85.41

Appendix I (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
113	4.96	94.50	81.44	94.35	81.25
117	5.00	97.05	81.72	96.85	81.24
104	5.02	95.30	82.09	95.15	80.96
110	5.05	93.73	86.58	93.65	86.01
106	5.06	94.65	84.39	94.63	82.90
116	5.07	95.93	82.27	95.75	81.81
107	5.09	95.93	81.75	95.88	78.76
16	5.09	98.00	89.09	98.00	89.14
95	5.09	94.58	84.17	94.53	83.83
35	5.10	94.58	87.44	94.58	86.14
19	5.12	97.38	86.93	97.35	86.00
7	5.16	97.48	85.27	97.45	85.19
33	5.16	94.65	85.51	94.57	85.06
63	5.16	96.20	82.89	96.10	80.69
121	5.18	94.75	81.19	94.73	81.06
57	5.22	95.10	99.11	95.05	97.79
12	5.25	96.93	88.12	96.80	87.76
105	5.25	95.48	87.68	95.40	87.05
36	5.26	95.18	86.39	95.10	85.41
59	5.27	97.58	88.02	97.50	87.84
30	5.28	94.68	87.72	94.70	87.71
103	5.32	95.10	81.19	94.93	80.76
18	5.34	97.73	90.12	97.70	90.06
37	5.37	94.83	86.08	94.75	85.42
15	5.44	97.33	84.63	97.30	84.56
31	5.54	94.48	90.59	94.50	90.56
72	5.56	96.78	83.88	96.70	83.70
71	5.61	96.70	84.29	96.65	83.24
101	5.67	95.80	90.42	95.73	89.65
34	5.68	95.30	91.67	95.25	91.56
48	5.81	97.78	92.34	97.78	90.24
1	5.87	97.08	86.07	97.05	86.10
47	5.91	97.60	92.45	97.68	91.16
49	5.93	98.00	93.50	97.93	92.63
94	6.04	96.15	84.24	95.98	83.34
124	6.05	96.30	85.77	96.30	85.23
50	6.16	97.18	90.52	97.35	89.69
100	6.32	97.45	87.79	97.28	87.68
2	6.35	96.40	86.79	96.33	86.61
46	6.43	97.90	93.25	97.85	92.91
45	6.49	97.63	93.90	97.60	92.45
65	6.56	96.80	95.32	96.58	94.25
90	6.74	97.65	91.16	97.65	90.90

Appendix I (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
68	6.91	98.00	91.64	97.90	90.22
127	7.11	98.25	95.03	98.25	94.69
62	7.16	98.20	94.67	98.03	94.48

Appendix J

Summary of X-Rite 948 Results in Visual Rank Order

Appendix J

Summary of X-Rite 948 Results in Visual Rank Order

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
70	1.98	96.21	68.33	96.22	68.76
82	2.16	92.19	62.30	92.24	63.09
74	2.41	96.59	60.43	96.64	61.30
21	2.56	96.88	59.83	97.02	60.17
120	2.76	93.26	68.48	93.32	69.21
3	2.79	96.44	63.76	96.44	64.45
119	2.80	93.47	67.63	93.61	68.47
102	2.80	93.82	69.56	93.94	69.99
20	2.82	97.38	62.72	97.38	63.38
17	2.90	96.02	62.49	95.99	63.42
111	2.92	92.73	66.25	92.79	66.88
14	3.00	96.09	68.09	96.01	67.90
73	3.02	96.29	64.30	96.29	64.99
87	3.06	92.16	69.02	92.21	69.31
126	3.13	92.68	66.81	92.82	67.22
93	3.22	95.72	68.31	95.81	69.03
79	3.24	94.29	71.95	94.32	72.01
43	3.26	93.15	78.06	93.15	77.82
13	3.28	95.87	67.86	95.50	69.14
69	3.30	96.47	65.65	96.27	66.26
118	3.32	93.39	70.72	93.46	71.28
67	3.33	93.19	75.08	93.21	74.78
66	3.34	92.27	71.45	92.32	71.72
78	3.34	94.43	70.19	94.51	70.62
4	3.35	96.73	69.24	96.69	69.30
98	3.38	94.10	74.98	94.18	75.24
77	3.39	94.72	71.39	94.71	71.70
64	3.43	92.83	78.76	92.87	78.50
109	3.54	94.84	76.59	94.85	76.61
40	3.55	93.38	78.66	93.35	78.68
42	3.58	93.23	77.51	93.25	77.13
86	3.59	96.08	66.99	96.09	67.66
112	3.62	93.15	75.98	93.30	76.48
125	3.65	93.39	84.31	93.50	84.22
44	3.70	93.43	77.22	93.45	77.00
91	3.71	93.29	81.26	93.35	81.04
39	3.76	93.87	79.63	93.92	79.66
38	3.84	93.59	78.71	93.61	78.92
108	3.86	95.76	79.52	95.87	79.62

Appendix J (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
123	3.92	94.58	81.94	94.74	82.45
76	3.95	96.34	75.13	96.33	75.60
97	3.96	92.66	75.81	92.72	76.04
89	3.99	93.68	80.24	93.72	79.92
24	4.01	94.58	82.12	94.67	82.14
41	4.08	94.13	82.64	94.15	82.51
114	4.09	95.94	80.61	95.94	80.76
56	4.21	95.44	83.60	95.45	83.33
128	4.22	93.87	83.97	94.01	83.88
26	4.22	94.81	83.98	94.83	83.12
84	4.23	93.55	83.75	93.58	83.06
75	4.25	96.42	78.82	96.45	78.98
22	4.27	95.14	83.34	95.11	83.72
52	4.29	95.68	83.81	95.63	83.93
81	4.29	94.33	80.60	94.37	80.37
55	4.30	96.58	82.60	96.54	82.01
5	4.31	97.00	80.89	96.95	81.09
27	4.33	95.18	84.55	95.23	84.22
83	4.33	95.23	81.98	95.30	82.13
92	4.37	94.33	83.33	94.40	83.14
23	4.39	94.86	84.47	94.88	84.33
29	4.41	94.80	83.61	94.78	82.91
25	4.48	95.06	86.52	95.10	86.38
58	4.51	94.17	86.15	94.20	86.22
96	4.54	94.46	86.77	94.49	86.84
115	4.55	96.27	83.03	96.30	83.78
88	4.56	94.74	85.48	94.78	84.97
28	4.58	95.04	86.45	95.08	86.06
6	4.59	96.30	85.71	96.39	85.50
8	4.68	97.50	87.77	97.40	87.70
51	4.69	95.47	82.73	95.49	82.53
10	4.79	97.38	87.41	97.38	86.82
60	4.81	96.95	88.87	97.03	88.40
80	4.81	96.43	85.45	96.48	85.40
54	4.83	96.23	80.51	96.26	80.43
99	4.84	95.79	84.14	95.93	84.23
122	4.86	95.78	92.88	95.90	92.66
85	4.87	96.45	89.60	96.56	89.44
9	4.93	97.60	88.69	97.65	87.98
11	4.95	96.74	86.04	96.61	85.88
61	4.96	97.63	82.11	97.70	81.95
53	4.96	94.99	90.86	94.95	90.70
32	4.96	94.95	90.72	94.97	89.68

Appendix J (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
113	4.96	94.59	94.67	94.64	94.21
117	5.00	97.00	90.16	97.09	90.30
104	5.02	95.68	92.81	95.76	92.49
110	5.05	93.88	98.32	94.00	98.16
106	5.06	95.01	94.65	95.06	94.43
116	5.07	95.98	93.09	96.13	92.67
107	5.09	96.13	94.82	96.21	94.17
16	5.09	98.05	87.96	98.13	87.32
95	5.09	94.54	91.99	94.51	91.43
35	5.10	94.78	91.22	94.80	90.19
19	5.12	97.63	87.76	97.64	87.53
7	5.16	97.62	88.99	97.58	88.55
33	5.16	94.86	91.86	94.93	91.02
63	5.16	96.15	94.32	96.17	93.13
121	5.18	94.83	91.60	94.92	91.55
57	5.22	94.97	87.73	94.95	87.75
12	5.25	96.97	89.68	96.93	89.15
105	5.25	95.83	92.98	95.88	92.76
36	5.26	95.31	90.68	95.32	90.28
59	5.27	97.52	86.90	97.55	86.31
30	5.28	94.87	92.78	94.82	91.66
103	5.32	95.12	94.60	95.20	94.45
18	5.34	97.73	86.33	97.77	85.75
37	5.37	95.11	93.69	95.10	92.91
15	5.44	97.15	86.50	97.22	86.35
31	5.54	94.58	95.05	94.63	94.66
72	5.56	96.86	99.29	96.86	98.11
71	5.61	96.76	97.61	96.82	96.66
101	5.67	95.80	92.76	95.88	92.68
34	5.68	95.39	93.40	95.35	92.48
48	5.81	97.92	94.27	97.87	93.65
1	5.87	97.22	95.99	97.21	95.61
47	5.91	97.84	91.38	97.82	91.57
49	5.93	98.11	93.37	98.15	92.47
94	6.04	96.15	99.57	96.18	98.72
124	6.05	96.36	101.18	96.53	100.99
50	6.16	97.60	101.94	97.47	100.79
100	6.32	97.05	97.09	97.21	96.89
2	6.35	96.72	101.21	96.59	100.54
46	6.43	97.95	103.47	98.01	102.26
45	6.49	97.80	101.24	97.85	100.10
65	6.56	96.89	103.84	96.94	102.94
90	6.74	97.73	100.76	97.73	100.09

Appendix J (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
68	6.91	97.35	106.90	97.41	105.89
127	7.11	97.84	108.11	97.98	107.62
62	7.16	97.90	109.18	97.90	108.52

Appendix K

Summary of Minolta CR-200b Results in Grade Code Order

Appendix K

Summary of Minolta CR-200b Results in Grade Code Order

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
1	5.87	97.08	86.07	97.05	86.10
2	6.35	96.40	86.79	96.33	86.61
3	2.79	96.65	73.38	96.58	73.20
4	3.35	96.78	76.89	96.93	77.21
5	4.31	96.93	78.87	96.95	78.96
6	4.59	96.30	79.99	96.40	79.95
7	5.16	97.48	85.27	97.45	85.19
8	4.68	97.18	83.71	97.23	83.01
9	4.93	97.48	87.53	97.38	86.31
10	4.79	97.13	84.39	97.10	84.29
11	4.95	96.93	78.99	97.00	79.01
12	5.25	96.93	88.12	96.80	87.76
13	3.28	96.13	66.94	96.05	66.84
14	3.00	96.08	64.39	96.00	64.09
15	5.44	97.33	84.63	97.30	84.56
16	5.09	98.00	89.09	98.00	89.14
17	2.90	96.23	72.40	96.28	72.07
18	5.34	97.73	90.12	97.70	90.06
19	5.12	97.38	86.93	97.35	86.00
20	2.82	97.60	73.36	97.55	73.25
21	2.56	97.03	69.99	96.98	70.26
22	4.27	95.10	78.29	95.00	78.27
23	4.39	94.88	75.57	94.78	75.41
24	4.01	94.55	75.48	94.45	75.17
25	4.48	95.05	77.77	94.93	77.39
26	4.22	94.78	77.87	94.70	77.79
27	4.33	95.15	78.79	95.18	78.81
28	4.58	94.85	78.12	94.88	78.16
29	4.41	94.70	78.35	94.75	78.00
30	5.28	94.68	87.72	94.70	87.71
31	5.54	94.48	90.59	94.50	90.56
32	4.96	94.80	85.88	94.80	85.41
33	5.16	94.65	85.51	94.57	85.06
34	5.68	95.30	91.67	95.25	91.56
35	5.10	94.58	87.44	94.58	86.14
36	5.26	95.18	86.39	95.10	85.41
37	5.37	94.83	86.08	94.75	85.42
38	3.84	93.40	85.57	93.40	84.95
39	3.76	93.80	83.94	93.78	83.30

Appendix K (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
40	3.55	93.10	84.36	93.05	83.65
41	4.08	93.85	84.89	93.83	85.08
42	3.58	93.20	77.57	93.13	77.46
43	3.26	93.00	75.47	93.00	75.39
44	3.70	93.28	77.77	93.30	77.66
45	6.49	97.63	93.90	97.60	92.45
46	6.43	97.90	93.25	97.85	92.91
47	5.91	97.60	92.45	97.68	91.16
48	5.81	97.78	92.34	97.78	90.24
49	5.93	98.00	93.50	97.93	92.63
50	6.16	97.18	90.52	97.35	89.69
51	4.69	95.28	79.99	95.28	78.45
52	4.29	95.35	81.37	95.43	80.70
53	4.96	95.08	83.40	95.05	82.92
54	4.83	96.43	91.41	96.40	90.48
55	4.30	96.53	81.34	96.45	80.26
56	4.21	95.38	78.52	95.38	79.12
57	5.22	95.10	99.11	95.05	97.79
58	4.51	94.23	97.14	94.23	95.76
59	5.27	97.58	88.02	97.50	87.84
60	4.81	96.98	80.74	96.93	79.60
61	4.96	97.75	91.44	97.85	91.19
62	7.16	98.20	94.67	98.03	94.48
63	5.16	96.20	82.89	96.10	80.69
64	3.43	92.90	79.34	92.80	77.75
65	6.56	96.80	95.32	96.58	94.25
66	3.34	92.38	82.71	92.30	82.19
67	3.33	93.18	75.02	93.05	75.93
68	6.91	98.00	91.64	97.90	90.22
69	3.30	96.65	76.08	96.55	75.25
70	1.98	96.40	70.52	96.28	68.51
71	5.61	96.70	84.29	96.65	83.24
72	5.56	96.78	83.88	96.70	83.70
73	3.02	96.70	73.05	96.55	72.38
74	2.41	96.73	67.57	96.60	67.74
75	4.25	96.63	88.56	96.45	87.76
76	3.95	96.50	84.73	96.30	83.56
77	3.39	94.88	76.52	94.88	75.56
78	3.34	94.55	77.39	94.58	77.41
79	3.24	94.33	76.04	94.10	75.19
80	4.81	96.38	84.61	96.23	83.62
81	4.29	94.35	74.47	94.33	74.34
82	2.16	92.28	72.94	92.20	72.71

Appendix K (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
83	4.33	95.40	77.47	95.40	77.10
84	4.23	93.70	82.09	93.53	81.05
85	4.87	96.38	77.62	96.40	77.55
86	3.59	96.55	77.46	96.35	76.95
87	3.06	92.13	79.50	92.10	79.71
88	4.56	94.70	76.82	94.68	76.50
89	3.99	93.68	73.85	93.63	73.51
90	6.74	97.65	91.16	97.65	90.90
91	3.71	93.38	80.47	93.25	78.78
92	4.37	94.53	82.37	94.43	81.40
93	3.22	95.90	71.44	95.90	70.56
94	6.04	96.15	84.24	95.98	83.34
95	5.09	94.58	84.17	94.53	83.83
96	4.54	94.45	80.86	94.45	80.80
97	3.96	92.78	81.69	92.73	81.56
98	3.38	94.30	75.62	94.10	76.26
99	4.84	96.03	79.32	96.03	79.58
100	6.32	97.45	87.79	97.28	87.68
101	5.67	95.80	90.42	95.73	89.65
102	2.80	93.35	73.67	93.30	72.76
103	5.32	95.10	81.19	94.93	80.76
104	5.02	95.30	82.09	95.15	80.96
105	5.25	95.48	87.68	95.40	87.05
106	5.06	94.65	84.39	94.63	82.90
107	5.09	95.93	81.75	95.88	78.76
108	3.86	95.35	78.49	95.30	77.41
109	3.54	94.40	75.08	94.30	74.45
110	5.05	93.73	86.58	93.65	86.01
111	2.92	92.80	77.64	92.80	77.54
112	3.62	92.93	76.99	92.85	76.71
113	4.96	94.50	81.44	94.35	81.25
114	4.09	95.58	77.73	95.53	76.34
115	4.55	95.88	84.95	95.80	84.67
116	5.07	95.93	82.27	95.75	81.81
117	5.00	97.05	81.72	96.85	81.24
118	3.32	93.58	80.89	93.58	80.84
119	2.80	93.65	78.99	93.55	78.36
120	2.76	93.30	79.86	93.30	79.41
121	5.18	94.75	81.19	94.73	81.06
122	4.86	95.75	83.57	95.68	82.91
123	3.92	94.68	73.60	94.60	73.29
124	6.05	96.30	85.77	96.30	85.23
125	3.65	93.45	76.07	93.43	74.66

Appendix K (continued)

Grade Code	Visual Rank	L* ILL C Minolta	CIE WI ILL C Minolta	L* ILL D65 Minolta	CIE WI ILL D65 Minolta
=====	=====	=====	=====	=====	=====
126	3.13	92.83	77.57	92.78	77.80
127	7.11	98.25	95.03	98.25	94.69
128	4.22	93.93	81.02	93.90	78.31

Appendix L

Summary of X-Rite 948 Results in Grade Code Order

Appendix L

Summary of X-Rite 948 Results in Grade Code Order

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
1	5.87	97.22	95.99	97.21	95.61
2	6.35	96.72	101.21	96.59	100.54
3	2.79	96.44	63.76	96.44	64.45
4	3.35	96.73	69.24	96.69	69.30
5	4.31	97.00	80.89	96.95	81.09
6	4.59	96.30	85.71	96.39	85.50
7	5.16	97.62	88.99	97.58	88.55
8	4.68	97.50	87.77	97.40	87.70
9	4.93	97.60	88.69	97.65	87.98
10	4.79	97.38	87.41	97.38	86.82
11	4.95	96.74	86.04	96.61	85.88
12	5.25	96.97	89.68	96.93	89.15
13	3.28	95.87	67.86	95.50	69.14
14	3.00	96.09	68.09	96.01	67.90
15	5.44	97.15	86.50	97.22	86.35
16	5.09	98.05	87.96	98.13	87.32
17	2.90	96.02	62.49	95.99	63.42
18	5.34	97.73	86.33	97.77	85.75
19	5.12	97.63	87.76	97.64	87.53
20	2.82	97.38	62.72	97.38	63.38
21	2.56	96.88	59.83	97.02	60.17
22	4.27	95.14	83.34	95.11	83.72
23	4.39	94.86	84.47	94.88	84.33
24	4.01	94.58	82.12	94.67	82.14
25	4.48	95.06	86.52	95.10	86.38
26	4.22	94.81	83.98	94.83	83.12
27	4.33	95.18	84.55	95.23	84.22
28	4.58	95.04	86.45	95.08	86.06
29	4.41	94.80	83.61	94.78	82.91
30	5.28	94.87	92.78	94.82	91.66
31	5.54	94.58	95.05	94.63	94.66
32	4.96	94.95	90.72	94.97	89.68
33	5.16	94.86	91.86	94.93	91.02
34	5.68	95.39	93.40	95.35	92.48
35	5.10	94.78	91.22	94.80	90.19
36	5.26	95.31	90.68	95.32	90.28
37	5.37	95.11	93.69	95.10	92.91
38	3.84	93.59	78.71	93.61	78.92
39	3.76	93.87	79.63	93.92	79.66

Appendix L (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
40	3.55	93.38	78.66	93.35	78.68
41	4.08	94.13	82.64	94.15	82.51
42	3.58	93.23	77.51	93.25	77.13
43	3.26	93.15	78.06	93.15	77.82
44	3.70	93.43	77.22	93.45	77.00
45	6.49	97.80	101.24	97.85	100.10
46	6.43	97.95	103.47	98.01	102.26
47	5.91	97.84	91.38	97.82	91.57
48	5.81	97.92	94.27	97.87	93.65
49	5.93	98.11	93.37	98.15	92.47
50	6.16	97.60	101.94	97.47	100.79
51	4.69	95.47	82.73	95.49	82.53
52	4.29	95.68	83.81	95.63	83.93
53	4.96	94.99	90.86	94.95	90.70
54	4.83	96.23	80.51	96.26	80.43
55	4.30	96.58	82.60	96.54	82.01
56	4.21	95.44	83.60	95.45	83.33
57	5.22	94.97	87.73	94.95	87.75
58	4.51	94.17	86.15	94.20	86.22
59	5.27	97.52	86.90	97.55	86.31
60	4.81	96.95	88.87	97.03	88.40
61	4.96	97.63	82.11	97.70	81.95
62	7.16	97.90	109.18	97.90	108.52
63	5.16	96.15	94.32	96.17	93.13
64	3.43	92.83	78.76	92.87	78.50
65	6.56	96.89	103.84	96.94	102.94
66	3.34	92.27	71.45	92.32	71.72
67	3.33	93.19	75.08	93.21	74.78
68	6.91	97.35	106.90	97.41	105.89
69	3.30	96.47	65.65	96.27	66.26
70	1.98	96.21	68.33	96.22	68.76
71	5.61	96.76	97.61	96.82	96.66
72	5.56	96.86	99.29	96.86	98.11
73	3.02	96.29	64.30	96.29	64.99
74	2.41	96.59	60.43	96.64	61.30
75	4.25	96.42	78.82	96.45	78.98
76	3.95	96.34	75.13	96.33	75.60
77	3.39	94.72	71.39	94.71	71.70
78	3.34	94.43	70.19	94.51	70.62
79	3.24	94.29	71.95	94.32	72.01
80	4.81	96.43	85.45	96.48	85.40
81	4.29	94.33	80.60	94.37	80.37
82	2.16	92.19	62.30	92.24	63.09

Appendix L (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
83	4.33	95.23	81.98	95.30	82.13
84	4.23	93.55	83.75	93.58	83.06
85	4.87	96.45	89.60	96.56	89.44
86	3.59	96.08	66.99	96.09	67.66
87	3.06	92.16	69.02	92.21	69.31
88	4.56	94.74	85.48	94.78	84.97
89	3.99	93.68	80.24	93.72	79.92
90	6.74	97.73	100.76	97.73	100.09
91	3.71	93.29	81.26	93.35	81.04
92	4.37	94.33	83.33	94.40	83.14
93	3.22	95.72	68.31	95.81	69.03
94	6.04	96.15	99.57	96.18	98.72
95	5.09	94.54	91.99	94.51	91.43
96	4.54	94.46	86.77	94.49	86.84
97	3.96	92.66	75.81	92.72	76.04
98	3.38	94.10	74.98	94.18	75.24
99	4.84	95.79	84.14	95.93	84.23
100	6.32	97.05	97.09	97.21	96.89
101	5.67	95.80	92.76	95.88	92.68
102	2.80	93.82	69.56	93.94	69.99
103	5.32	95.12	94.60	95.20	94.45
104	5.02	95.68	92.81	95.76	92.49
105	5.25	95.83	92.98	95.88	92.76
106	5.06	95.01	94.65	95.06	94.43
107	5.09	96.13	94.82	96.21	94.17
108	3.86	95.76	79.52	95.87	79.62
109	3.54	94.84	76.59	94.85	76.61
110	5.05	93.88	98.32	94.00	98.16
111	2.92	92.73	66.25	92.79	66.88
112	3.62	93.15	75.98	93.30	76.48
113	4.96	94.59	94.67	94.64	94.21
114	4.09	95.94	80.61	95.94	80.76
115	4.55	96.27	83.03	96.30	83.78
116	5.07	95.98	93.09	96.13	92.67
117	5.00	97.00	90.16	97.09	90.30
118	3.32	93.39	70.72	93.46	71.28
119	2.80	93.47	67.63	93.61	68.47
120	2.76	93.26	68.48	93.32	69.21
121	5.18	94.83	91.60	94.92	91.55
122	4.86	95.78	92.88	95.90	92.66
123	3.92	94.58	81.94	94.74	82.45
124	6.05	96.36	101.18	96.53	100.99
125	3.65	93.39	84.31	93.50	84.22

Appendix L (continued)

Grade Code	Visual Rank	L* ILL C X-Rite	CIE WI ILL C X-Rite	L* ILL D65 X-Rite	CIE WI ILL D65 X-Rite
=====	=====	=====	=====	=====	=====
126	3.13	92.68	66.81	92.82	67.22
127	7.11	97.84	108.11	97.98	107.62
128	4.22	93.87	83.97	94.01	83.88