# Whiteness and Brightness

## Understanding the difference between whiteness and brightness is key to making a paper choice that shows your work at its best.

Whiteness and brightness can be confusing. But once you understand the difference, you will be able to choose the paper that is best for your project.

### BRIGHTNESS

**WHAT IS BRIGHTNESS?**
Brightness represents a narrow measurement of reflectance, measuring only a specific wavelength of blue light. The industry uses blue light to measure a paper's brightness because the human eye perceives a slight bluish tint as "whiter" than the neutral white of the color spectrum.

**HOW IS BRIGHTNESS MEASURED?**
The scale used in the United States to measure brightness is the TAPPI (GE) scale, which is from 0 to 100. A 96 bright paper reflects more light of a particular wavelength than a 92 bright paper. Brightness does not measure other wavelengths of light. This means that two papers of identical brightness can be different colors (shade), which can affect how color graphics or imagery appears.

**BRIGHTER THAN 100?**
Some papers have a brightness of greater than 100. This is possible because there are two basic types of brightness measurement scales: The TAPPI (GE) scale used in the United States, which uses a directional light source, and the ISO and D65 scales, which use a diffuse source to measure brightness. There is no correlation between directional and diffuse brightness due to the differences in measurement techniques.

**COLOR SPECTRUM** WAVELENGTH (NM)

400  **457**  700
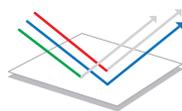
### WHITENESS

**WHAT IS WHITENESS?**
Whiteness describes the degree to which a paper reflects light of all wavelengths (colors), and, therefore, more closely corresponds to our perception of a paper's appearance.

**HOW IS WHITENESS MEASURED?**
In papermaking, to create a "white" sheet, dyes are mixed to produce a color balance that appears white. A slightly bluish tint helps whites appear their brightest; a neutral white helps colors pop. Since printing inks are translucent, the shade of paper you use can change how your colors perform.

**CONTEXT AND COMPARISON**
Where you are when you compare papers can make a big difference in how they appear. Since outdoor light includes ultraviolet, papers treated with OBAs (optical brightening agents) can appear brighter under outside light than they do indoors. Similarly, a white sheet not treated with OBAs may appear whiter indoors, but seem dull outside when compared with a sheet with OBAs.
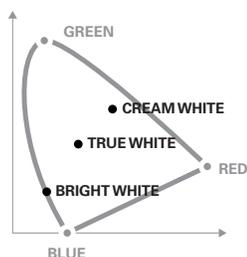
**COLOR SPECTRUM** WAVELENGTH (NM)

400  **ALL WAVELENGTHS**  700
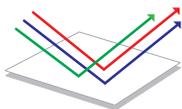
### SHADE

**WHAT IS SHADE?**
The term shade describes the subtle differences in color of different papers. There are three groups of shade for whites: cream white, true white, and bright white.

**CREAM WHITE** absorbs the cooler colors and, therefore, appears slightly yellowish.

**TRUE WHITE** refers to white paper that reflects the entire visible color spectrum equally; this balanced white is sometimes called neutral white.

**BRIGHT WHITE** refers to paper with a slightly bluish tint; this can make the white look brighter and whiter. Bright white is also called blue white or high white.
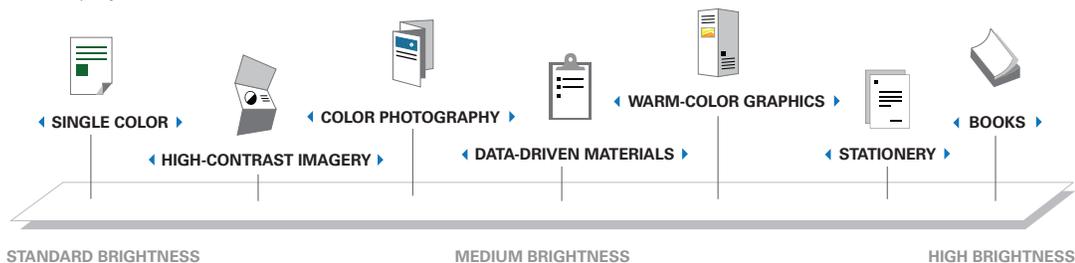
Our eyes are more sensitive to color than to brightness. If you take two sheets with the same shade (color balance) but two points apart in brightness values, the human eye would have a difficult time detecting the difference.

As we will see, each shade of white is useful in the right situation.

**C.I.E. CHROMACTICITY DIAGRAM**

GREEN

● CREAM WHITE

● TRUE WHITE

RED

● BRIGHT WHITE

BLUE

INTERNATIONAL PAPER

Hammermill®

# Whiteness and Brightness

## Let content and use drive your choice of paper

How and where your project will be seen or used is very important. The needs of a technical manual or book are very different from an outdoor poster or flyer. The user experience also introduces practical considerations like eye fatigue and readability that can help guide your selection. Of course, design elements such as whitespace and color palette can also help you decide which paper is appropriate for the project.



◄ SINGLE COLOR ►

◄ HIGH-CONTRAST IMAGERY ►

◄ COLOR PHOTOGRAPHY ►

◄ DATA-DRIVEN MATERIALS ►

◄ WARM-COLOR GRAPHICS ►

◄ STATIONERY ►

◄ BOOKS ►

STANDARD BRIGHTNESS     MEDIUM BRIGHTNESS     HIGH BRIGHTNESS

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### TEXT-HEAVY

Book publishers tend to favor cream or neutral whites, because the lower contrast is less fatiguing for the eye.

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### MONOCHROME OR SINGLE-COLOR

For a single-color or black-and-white project with just a few drawings or diagrams, such as a direct mail piece, technical paper, or a booklet with line drawings, a bright white paper will provide high-contrast image clarity and crisp text.
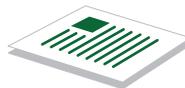
For color printing, be sure to consider whiteness. How the inks or toners interact with the shade of the paper can affect how your colors perform and whether the end result achieves the results you want, such as natural-looking flesh tones.

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### GRAPHICS

For a project that features color photography, illustration, artwork or graphics, you will want to consider the color balance of the imagery. Generally, such work covers a wide range of the spectrum, and a neutral white paper will help all the colors stay true and pop.

#### COOL COLORS
Some projects feature imagery and a graphic palette that are all cool colors. Here, a bright white paper would not muddy the colors; the images and text would contrast well with the bright white, providing a crisp and clear result.

#### WARM COLORS
For a project confined to a warm color palette, a cream white sheet would work well to enhance the warm colors of the piece.
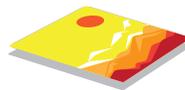
If you are planning a project and have questions about which paper might work best, be sure to contact your International Paper representative to learn more about Accent® Opaque, Hammermill®, HP®, Springhill®, and Williamsburg brands.

Printed on Hammermill Color Copy Digital Cover, 60 lb. on a Canon® imagePRESS® C7000VP.