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Explanation of Hue Error and Grayness

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A Brief Explanation of Hue Error and Grayness

Measuring and controlling the color and contamination levels of printing inks is a very important and primary step in achieving consistent color on press. Typically ink manufacturers and large printers with in-house testing facilities use spectrophotometers and colorimeters to measure color. These instruments break down an overall appearance of a color in terms of Lightness, Hue, and Saturation which are calculated from measuring the electromagnetic footprint of an ink. Although very precise and repeatable these instruments do come with a high price tag.

WHY?

If a spectrophotometer or colorimeter is not available to you there is another way to go about checking your incoming process inks for color. By using a densitometer and calculating Hue Error and Grayness, we can detect the amount of contamination present in each of the three process colors: Cyan, Magenta, and Yellow.

Hue Error and Grayness are calculated in order to measure and control the amount of contamination present in printing inks. Because it is not economically feasible to produce pure printing inks, we must accept a certain amount of contamination in the process inks. Contamination is not necessarily a negative thing as long as your contamination levels remain consitent.

HOW?

A standard color reflection densitometer has four filters used to measure the densities of the four process colors; black, cyan, magenta, and yellow. By putting one of these filters inbetween the reflective surface (ink and paper) and the collecting optics, the densitometer can assume which color it is looking at

Let's assume that all ink is made with different proportions of cyan, magenta and yellow. By measuring an ink through each individual filter, an ink profile can be made up which illustrates the amount of each color present in the ink. Study the illustration below.

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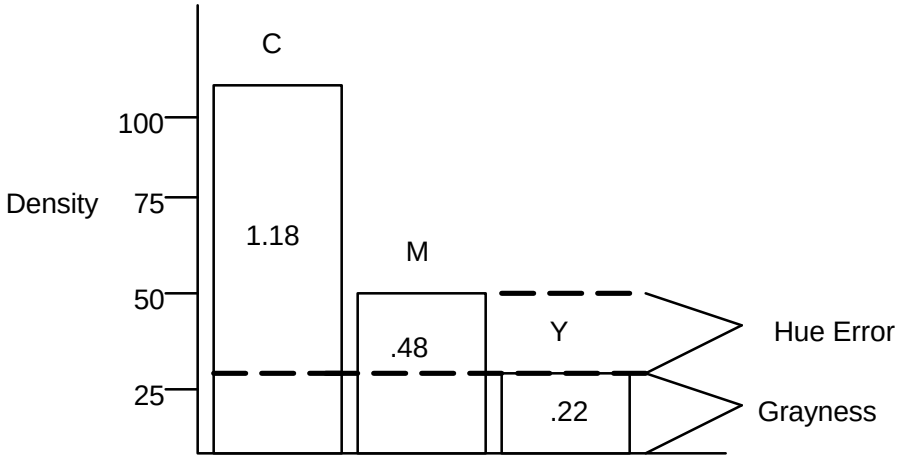
Doc# Ga00034a.doc
April 19, 1996

HUE ERROR and GRAYNESS

CYAN INK



Here it can be shown that cyan ink not only contains the color cyan but also contains some amounts of magenta and yellow. These portions of yellow and magenta are the contaminating portions of the cyan ink. So where does Hue Error and Grayness come in?

GRAYNESS

Grayness first. Under the *Subtractive Color Theory,* any equal proportion of cyan, magenta, and yellow will yield a gray, or in the extreme case, black. Hence,

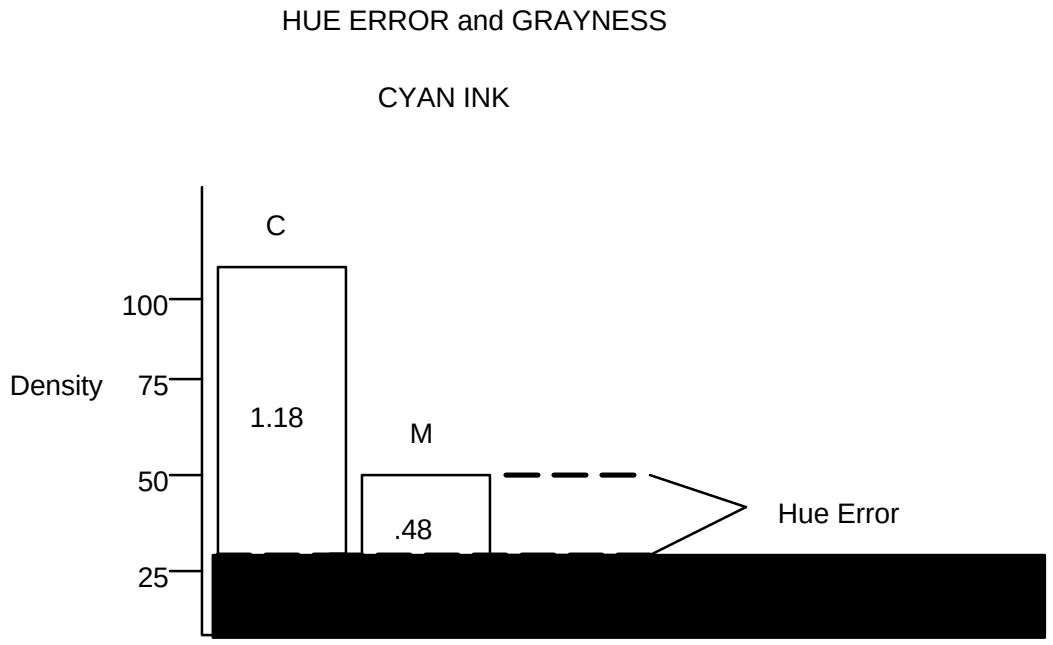
C + M + Y = K or Gray

Notice that there is equal portions of CMY present in this cyan ink. In fact, the amount of yellow basically dictates the amount of gray or Grayness in the ink. Taking this further it can then be said that *Grayness is a measure of the lower contaminating portion of an ink.*

Grayness is a property of the ink that causes it to look *dirty* or *dull* taking away the saturated or brilliance of the ink. It *does not* necessarily change the color or hue.

HUE ERROR

Now take out the Grayness and look at what is left.



There is still some magenta present. But this time there isn't any yellow to offset it and make the overall appearance grayer. Here the magenta *is* changing the hue or color of the cyan causing it to look more on the reflex blue or purple side. This leftover portion of magenta is called the *HUE ERROR.* Taking this further, it can be said that *Hue Error is the measure of the larger contaminating portion of an ink.*

In Conclusion

There are other reasons why you would want to measure Hue Error and Grayness. Many times under certain conditions an ink may backtrap. This happens as one ink is being applied on top of another, say yellow on top of magenta, where the former actually pulls up the first down ink causing an additional increase in contamination. In this case magenta would be pulled up by the yellow ink, hence contaminating the yellow for subsequent impressions. Hue Error and Grayness would recognize this problem.

Paper and special colors can also be measured using the three filter approach with Hue Error and Grayness for a further incoming material test.

In short, there is no way to dodge Hue Error and Grayness, but by maintaining the same level of contamination through measurement and control you can be assured that at least one of your inputs is consistent.