Increase amount of brightness in comparison of brightness

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An Effect of Contrast

The appearance of a color depends on the colors near it. In two squares with center circles of the same color , the brightness of the circles will appear to differ depending on the brightness of their backgrounds.

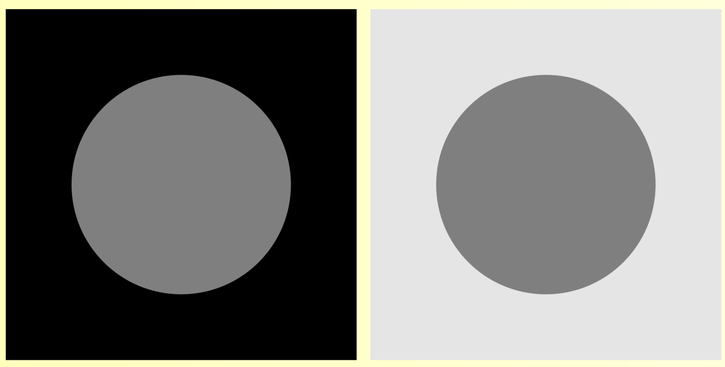

Figure 1: An effect of contrast

The brighter the background, the darker its circle appears.
In this research, we want to quantify perception of the difference in the brightness of the circles.

The experimental way

We prepared many printed samples with center circles of varying brightness. The size of the sample is 8 cm and the diameter of the circle is 5 cm. The background colors are black and lightgray(90% brightness) and the brightness of the center circles are from 40% to 60% in every 2% by HSL color value[2]. These samples are printed by Epson PX5002 inkjet printer on the paper Epson Crispia.

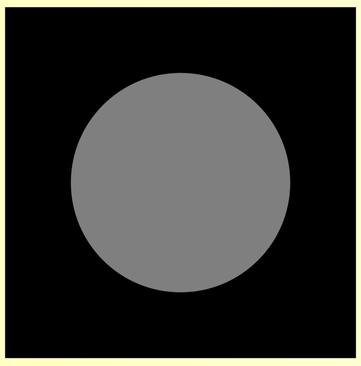

Figure 2: The refference Figure

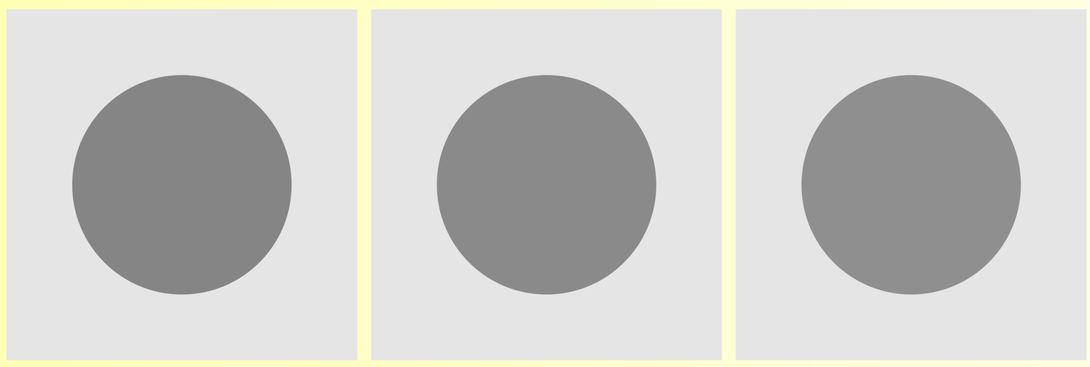

Figure 3: Example of Samples(gray of brightness 52%, 54% and 56%)

The brightness of the backgrounds in Figures2 and 3 are 0% and 90%, respectively.
We showed these samples to subjects and asked them to select a sample whose center circle has the same center brightness as the reference image.

Measurement of Colors

Since the printed color depends on the equipmnts, we have measured the colors of athe samples by a colorimeter TCD100[3]. The colore differences are culculaed by Excel datasheet given by [1].

Table 1: Color Values of the circles in Figure 3

H	S	L	L^*	a^*	b^*	dE
0	0	50	–	–	–	0
0	0	52				
0	0	54				
0	0	56				

Results

Conclusion

The colors of the samples were evaluated in the L*a*b* color space by a colorimeter. The background color and circle brightness in the reference image are 80 and 60, respectively. When the samples' brightness of the background color were 40, approximately 6.6 differences were obtained.

References

[1] G. Sharma, W. Wu,E. N. Dalal, The CIEDE2000 Color-Difference Formula: Implementation Notes, Supplementary Test Data, and Mathematical Observations, COLOR research and application, pp.21-30, Vol.30, 2005
[2] W3C, CSS Color Module Level 3, https://www.w3.org/TR/css-color-3/#hsl-color
[3] TCD100, https://www.pce-instruments.com/f/english/media/colorimeter-catalog.pdf
[4] Jacques Ninio, *The Science of Illusions*, Cornell University Press, New York, 2001