Material hue vs. lighting hue

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Observers can easily differetiate between a pigmented stain and the white surface that it lies on. The same applies for a colour shadow cast on the same surface. Although the difference between these two kinds of colour appearance (referred to as material and lighting hues) is self-evident even for inexperienced observers, it has not been captured by any colour appearance model so far. Using multidimensional scaling (MDS) we have obtained experimental evidence for the dissociation of these two types of hue in the human colour vision.

The stimulus display consisted of 2 identical sets of Munsell papers (5R4/14, 5YR7/12, 5Y8/12, 5G6/10, 10BG5/8, 5PB5/12 and 10P5/12) illuminated independently by yellow, neutral, and blue lights. The CIE 1976 u'v'-coordinates of lights were (0.199, 0.530), (0.174, 0.476), and (0.183, 0.210). Dissimilarities between all the 210 paper/light pairs were evaluated by ranking for five trichromatic observers. As a standard pair, the paper 5Y8/12 lit by the yellow light and the paper 5PB5/12 lit by the blue light were presented all the time during the experiment indicating the rank 100.

In the MDS output configuration, the papers lit by the same light made a closed configuration retaining the same order as the Munsell book. The paper configurations for the yellow and blue lights were shifted parallel to each other along an orthogonal direction with that for the neutral light located in between. The direction of the shift is interpreted as the yellow-blue lighting dimension. The average shift between the yellow and blue lights along this dimension was 27.5% of its standard pair, between the blue and neutral lights 25.2, and between the yellow and neutral lights 9.4. The corresponding shifts in the u'v'-coordinates were 70, 56, and 16% respectively. We argue that the yellow-blue lighting dimension cannot be reduced to that of the reflected light.

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