Blackness

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Aims

Collect psychophysical data

To explore potential effect of culture (nationality/gender) on blackness preference

To support and test the development of blackness equations
Experiments

Paired comparison

Ranking
Experiments

Blackness perception – which of the samples is most black?

Blackness preference – which of the samples do you prefer?

Paired comparison
Experiments

Munsell samples were simulated on a display.

N0, N1, N2, then at Value 1 and Chroma 2, 5B, 5BG, 5G, 5GY, 5Y, %YR, %R, 5RP, 5P and 5PB
Pair Comparison I - Blackness preference

40 observers: China (12 female and 8 male), UK (12 female and 8 male)
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### Summary - Blackness perception

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Method</th>
<th>Finding</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Paired comparison</td>
<td>Darkest, least chromatic, samples most black. Bluish blacks (5PB) blacker than reddish and yellowish blacks (5R, 5RP and 5Y). N0 was the blackest sample.</td>
<td>No effect.</td>
</tr>
<tr>
<td>4</td>
<td>Paired comparison</td>
<td>The more chromatic a colour, the less black it is.</td>
<td>No effect.</td>
</tr>
<tr>
<td>5</td>
<td>Ranking</td>
<td>Bluish blacks blacker than reddish and yellowish blacks. The more chromatic a colour the less black it is.</td>
<td>No effect.</td>
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</tbody>
</table>
### Summary - Blackness preference

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<tr>
<td>3</td>
<td>Paired</td>
<td>Purplish and bluish blacks preferred to reddish and yellowish blacks. 5PB preferred to N0. The darkest, least chromatic black is not the most preferred.</td>
<td>Chinese / female observers prefer reddish blue-blacks; UK / male observers prefer greenish blue-blacks.</td>
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<tr>
<td></td>
<td>comparison</td>
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<tr>
<td>4</td>
<td>Paired</td>
<td>The more chromatic a colour, the less black it is.</td>
<td>Chinese / male observers prefer darker blacks; UK / female observers prefer lighter blacks.</td>
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<td>Purplish and bluish blacks preferred to reddish and yellowish blacks.</td>
<td>Chinese / female observers prefer reddish blue-blacks; UK / male observers prefer greenish blue-blacks. Chinese / male observers prefer darker blacks; UK / female observers prefer lighter blacks.</td>
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Blackness Prediction

\[
B_W = 8.6542 - 0.2583L^* - 0.0052a^{*2} + 0.0045b^{*2}
\]

Westland et al., 2006

\[
B_C = 3.02 - 0.05 \left\{ (L^*)^2 + 0.89(a^*+2)^2 + 0.36(b^*-33)^2 \right\}^{1/2}
\]

Cho et al., 2013

\[
B_{CIE} = cY + d(xn - x) + e(yn - y)
\]

Based on CIE W
Blackness Prediction

<table>
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<tr>
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<th>Westland</th>
<th>Cho</th>
<th>CIE</th>
</tr>
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<tbody>
<tr>
<td>13 samples paired comparison (mainly hue varying)</td>
<td>0.25</td>
<td>0.59</td>
<td>0.99</td>
</tr>
<tr>
<td>29 samples ranking</td>
<td>0.17</td>
<td>0.13</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Table shows $r^2$ values
Blackness Prediction

![Graph of Observer's Response vs. Predicted Value with a correlation coefficient of 0.99]
Tentative Conclusions

Asking about how black something is and how much someone prefers a black are probably very different things

For blackness perception, the results are broadly consistent with the literature and find no nationality / gender effects

For blackness preference, the results show some interesting nationality / gender effects

A modified form of the CIE W equation may be useful for predicting blackness perception