

# Achromatic colour vision with relative luminance

## Mathematical equations with potential functions

$$F_{cb}(L_r, n) = b \tanh(x_r/c) = b \frac{L_r^n - L_r^{-n}}{L_r^n + L_r^{-n}} \quad \begin{array}{l} x_r = \log(L_r) \\ L_r = L/L_u \\ x_r \geq 0 \end{array} \quad [1]$$

$$\frac{dF_{cb}(L_r, n)}{dL_r} = \frac{4bm}{L_r[L_r^n + L_r^{-n}]^2} \quad \begin{array}{l} x_r = \ln L_r / \ln(10) \\ dx_r/dL_r = 1/(\ln(10)L_r) \\ n = 1/(\ln(10)c) \end{array} \quad [5]$$

$$\frac{L/dL}{(L/dL)_u} = \frac{4L}{L_r[L_r^n + L_r^{-n}]^2 L_u}; \quad \frac{dL}{dL_u} = \frac{L_r[L_r^n + L_r^{-n}]^2}{4} \quad [8]$$

$$\frac{L/dL}{(L/dL)_u} = 1 \text{ for } \begin{cases} L_r = 1 \\ x_r = 0 \end{cases} \quad \frac{dL}{dL_u} = 1 \text{ for } \begin{cases} L_r = 1 \\ x_r = 0 \end{cases} \quad [9]$$