

Appendix A: Standardised Relative Spectral Sensitivity Values $V(\lambda)$

| λ | $V(\lambda)$ | λ | $V(\lambda)$ | λ | $V(\lambda)$ |
|------------|--------------|-----------|--------------|-----------|--------------|
| 400 | 0.000396 | 500 | 0.323000 | 600 | 0.631000 |
| 405 | 0.000640 | 505 | 0.407300 | 605 | 0.566800 |
| 410 | 0.001210 | 510 | 0.503000 | 610 | 0.503000 |
| 415 | 0.002180 | 515 | 0.608200 | 615 | 0.441200 |
| 420 | 0.004000 | 520 | 0.710000 | 620 | 0.381000 |
| 425 | 0.007300 | 525 | 0.793200 | 625 | 0.321000 |
| 430 | 0.011600 | 530 | 0.862000 | 630 | 0.265000 |
| 435 | 0.016840 | 535 | 0.914850 | 635 | 0.217000 |
| 440 | 0.023000 | 540 | 0.954000 | 640 | 0.175000 |
| 445 | 0.029800 | 545 | 0.980300 | 645 | 0.138200 |
| 450 | 0.038000 | 550 | 0.994950 | 650 | 0.107000 |
| 455 | 0.048000 | 555 | 1.000000 | 655 | 0.081600 |
| 460 | 0.060000 | 560 | 0.995000 | 660 | 0.061000 |
| 465 | 0.073900 | 565 | 0.978600 | 665 | 0.044580 |
| 470 | 0.090980 | 570 | 0.952000 | 670 | 0.032000 |
| 475 | 0.112600 | 575 | 0.915400 | 675 | 0.023200 |
| 480 | 0.139020 | 580 | 0.870000 | 680 | 0.017000 |
| 485 | 0.169300 | 585 | 0.816300 | 685 | 0.011920 |
| 490 | 0.208020 | 590 | 0.757000 | 690 | 0.008210 |
| 495 | 0.258600 | 595 | 0.694900 | 695 | 0.005723 |
| CIE (1926) | | | | 700 | 0.004102 |

Appendix B: Calculation of x–y Chromaticity Coordinates

The CIE 1931 standard colorimetric observer is defined by the set of three colour-matching functions $\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$ given in Fig. 2.4. For the calculation, the values of these functions are given in tabular form in 5 nm wavelength intervals below (ISO/CIE 2007 and 2012). With these functions the tristimulus values X , Y and Z are calculated for a given spectral distribution $\Phi(\lambda)$, which should also be available in tabular form in the same wavelength intervals, from

$$X = \sum_{i=1}^n \Phi(\lambda)_i * \bar{x}(\lambda)_i$$
$$Y = \sum_{i=1}^n \Phi(\lambda)_i * \bar{y}(\lambda)_i$$
$$Z = \sum_{i=1}^n \Phi(\lambda)_i * \bar{z}(\lambda)_i$$

The chromaticity coordinates x and y are then calculated with

$$x = \frac{X}{X + Y + Z}$$
$$y = \frac{Y}{X + Y + Z}$$

CIE Colour-Matching Functions

| λ (nm) | $\bar{x}(\lambda)$ | $\bar{y}(\lambda)$ | $\bar{z}(\lambda)$ | $\bar{x}_{10}(\lambda)$ | $\bar{y}_{10}(\lambda)$ | $\bar{z}_{10}(\lambda)$ |
|----------------|--------------------|--------------------|--------------------|-------------------------|-------------------------|-------------------------|
| 380 | 0.0014 | 0.0000 | 0.0065 | 0.0002 | 0.0000 | 0.0007 |
| 385 | 0.0022 | 0.0001 | 0.0105 | 0.0007 | 0.0001 | 0.0029 |
| 390 | 0.0042 | 0.0001 | 0.0201 | 0.0024 | 0.0003 | 0.0105 |
| 395 | 0.0076 | 0.0002 | 0.0362 | 0.0072 | 0.0008 | 0.0323 |
| 400 | 0.0143 | 0.0004 | 0.0679 | 0.0191 | 0.0020 | 0.0860 |
| 405 | 0.0232 | 0.0006 | 0.1102 | 0.0434 | 0.0045 | 0.1971 |
| 410 | 0.0435 | 0.0012 | 0.2074 | 0.0847 | 0.0088 | 0.3894 |
| 415 | 0.0776 | 0.0022 | 0.3713 | 0.1406 | 0.0145 | 0.6568 |
| 420 | 0.1344 | 0.0040 | 0.6456 | 0.2045 | 0.0214 | 0.9725 |
| 425 | 0.2148 | 0.0073 | 10.391 | 0.2647 | 0.0295 | 12.825 |
| 430 | 0.2839 | 0.0116 | 13.856 | 0.3147 | 0.0387 | 15.535 |
| 435 | 0.3285 | 0.0168 | 16.230 | 0.3577 | 0.0496 | 17.985 |
| 440 | 0.3483 | 0.0230 | 17.471 | 0.3837 | 0.0621 | 19.673 |
| 445 | 0.3481 | 0.0298 | 17.826 | 0.3867 | 0.0747 | 20.273 |
| 450 | 0.3362 | 0.0380 | 17.721 | 0.3707 | 0.0895 | 19.948 |
| 455 | 0.3187 | 0.0480 | 17.441 | 0.3430 | 0.1063 | 19.007 |
| 460 | 0.2908 | 0.0600 | 16.692 | 0.3023 | 0.1282 | 17.454 |
| 465 | 0.2511 | 0.0739 | 15.281 | 0.2541 | 0.1528 | 15.549 |
| 470 | 0.1954 | 0.0910 | 12.876 | 0.1956 | 0.1852 | 13.176 |
| 475 | 0.1421 | 0.1126 | 10.419 | 0.1323 | 0.2199 | 10.302 |
| 480 | 0.0956 | 0.1390 | 8.130 | 0.0805 | 0.2536 | 7.721 |
| 485 | 0.0580 | 0.1693 | 6.162 | 0.0411 | 0.2977 | 5.701 |
| 490 | 0.0320 | 0.2080 | 4.652 | 0.0162 | 0.3391 | 4.153 |
| 495 | 0.0147 | 0.2586 | 3.533 | 0.0051 | 0.3954 | 3.024 |
| 500 | 0.0049 | 0.3230 | 2.720 | 0.0038 | 0.4608 | 2.185 |
| 505 | 0.0024 | 0.4073 | 2.123 | 0.0154 | 0.5314 | 1.592 |
| 510 | 0.0093 | 0.5030 | 1.582 | 0.0375 | 0.6067 | 1.120 |
| 515 | 0.0291 | 0.6082 | 1.117 | 0.0714 | 0.6857 | 0.822 |
| 520 | 0.0633 | 0.7100 | 0.782 | 0.1177 | 0.7618 | 0.607 |
| 525 | 0.1096 | 0.7932 | 0.573 | 0.1730 | 0.8233 | 0.431 |
| 530 | 0.1655 | 0.8620 | 0.422 | 0.2365 | 0.8752 | 0.305 |
| 535 | 0.2257 | 0.9149 | 0.298 | 0.3042 | 0.9238 | 0.206 |
| 540 | 0.2904 | 0.9540 | 0.203 | 0.3768 | 0.9620 | 0.137 |
| 545 | 0.3597 | 0.9803 | 0.134 | 0.4516 | 0.9822 | 0.079 |
| 550 | 0.4334 | 0.9950 | 0.087 | 0.5298 | 0.9918 | 0.040 |
| 555 | 0.5121 | 10.000 | 0.057 | 0.6161 | 0.9991 | 0.011 |
| 560 | 0.5945 | 0.9950 | 0.039 | 0.7052 | 0.9973 | 0.000 |
| 565 | 0.6784 | 0.9786 | 0.027 | 0.7938 | 0.9824 | 0.000 |
| 570 | 0.7621 | 0.9520 | 0.021 | 0.8787 | 0.9556 | 0.000 |
| 575 | 0.8425 | 0.9154 | 0.018 | 0.9512 | 0.9152 | 0.000 |
| 580 | 0.9163 | 0.8700 | 0.017 | 10.142 | 0.8689 | 0.000 |

(continued)

Appendix C: RVP Model of Weston

Formulas to calculate, based on Weston (1953) and CIE (2002), Weston’s relative visual performance RVP values for different contrast values (C), background luminances (L_b), visual angle α and age (a). The actual meaning of some of the intermediate parameters to be calculated is given in reference CIE (2002). Here we treat these parameters just as intermediate calculation functions.

For $C \geq 0.35$ and $\alpha \geq 1.5$:

$$X = 0.119 * (\log L_b + 1.923)^{0.0840} * (C + 1.516)^{-0.655}$$

$$Y = 0.814 * (\alpha - 1.182)^{-0.783} * (C + 1.054)^{-3.062}$$

$$Z = 0.575 * (\log L_b + 0.267)^{-0.390} * (\alpha - 0.830)^{-0.764}$$

$$E = (C + 0.199)^{-0.148} + 1.024$$

$$AF = 1 - (1.317 * 10^{-4}) * (a - 20)^E$$

$$RVP = 0.930 * (\alpha - 1.499)^X * (\log L_b + 0.0920)^Y * (C - 0.253)^Z * AF$$

For $C < 0.35$ and $\alpha \geq 1.5$:

$$X = 0.082 * (\log L_b + 0.113)^{-0.638} * (C + 0.0224)^{-0.23}$$

$$Y = 0.145 * (\alpha - 0.0041)^{-0.185} * (C - 0.099)^{0.117}$$

$$Z = 1.291 * (\log L_b + 0.264)^{-0.387} * (\alpha - 0.218)^{-0.523}$$

$$E = (C + 0.199)^{-0.148} + 1.024$$

$$AF = 1 - (1.317 * 10^{-4}) * (a - 20)^E$$

$$RVP = 1.137 * (\alpha - 1.499)^X * (\log L_b + 0.035)^Y * (C - 0.0852)^Z * AF$$

Appendix D: RVP Model of Rea

Go through steps 1–7 to calculate relative visual performance RVP for different contrast values (C_v), adaptation luminances (L_A) and age (a). The actual meaning of the intermediate parameters to be calculated in the different steps is given in reference (Rea and Ouellette 1991). Here we treat these parameters just as intermediate calculation functions.

- Step 1

$$I_{R'} = P * L_A * \pi * r^2$$

where

L_A = adaptation luminance in cd/m^2

$$r = 2.39 - \{1.22 * \tanh(0.3 * \log L_A)\}$$

$$P = 1 - 0.017 * (a - 20)$$

where

a = age of observer for 20–65 years

- Step 2

$$C'_{t,d} = \varepsilon * 10^{(-1.364 - 0.179 * A - 0.813 * L + 0.226 * A^2 - 0.0772 * L^2 + 0.169 * A * L)}$$

where

$$A = \log \tanh(20,000 * \omega)$$

$$L = \log\log\left(10 * \frac{I_{R'}}{\pi}\right)$$

$$\varepsilon = 1 + (0.00251) * (a - 20)$$

where

ω = area of the object in steradians

- Step 3

$$K = 10^{(-1.763 - 0.175 * AA - 0.0310 * LL + 0.112 * AA^2) + 0.171 * LL^2 + 0.0622 * AA * LL}$$

$$AA = \log\text{tanh}(5000 * \omega)$$

$$LL = \log\text{tanh}\left(0.04 * \frac{I_{R'}}{\pi}\right)$$

- Step 4

$$R_{\max} = 0.000196 * \log I_{R'} + 0.0027$$

- Step 5

$$RT = \frac{\Delta C_d^{0.97} + K^{0.97}}{\Delta C_d^{0.97} * R_{\max}}$$

$$\Delta C_d = C_v - C'_{t,d}; \quad \Delta C_d > 0$$

$$C_v = \frac{|L_B - L_T|}{L_B} = \frac{|E * \rho / \pi - L_T|}{L_B}$$

where:

L_B = background luminance in cd/m^2 (with uniform luminance $L_B = L_A$)

L_T = target (object) luminance in cd/m^2

L_{veil} = equivalent veiling luminance in cd/m^2

E = illuminance on object in lux

ρ = reflectance factor of object

- Step 6

$$\Delta T_{\text{vis}} = 305.4 - RT$$

- Step 7

$$RVP = 0.998 * \left(\frac{\Delta T_{\text{vis}} + 800}{777}\right)$$

$$RVP < 0 \rightarrow RVP = 0 \quad RVP > 1 \rightarrow RVP = 1$$

Appendix E: $E_{\text{vector}}/E_{\text{scalar}}$ Ratio

Calculation based on cubic illumination (Cuttle 1997) (Fig. E.1).

$E(x)$ and $E(-x)$ are two opposing illuminances on the x -axis

$E(y)$ and $E(-y)$ are two opposing illuminances on the y -axis

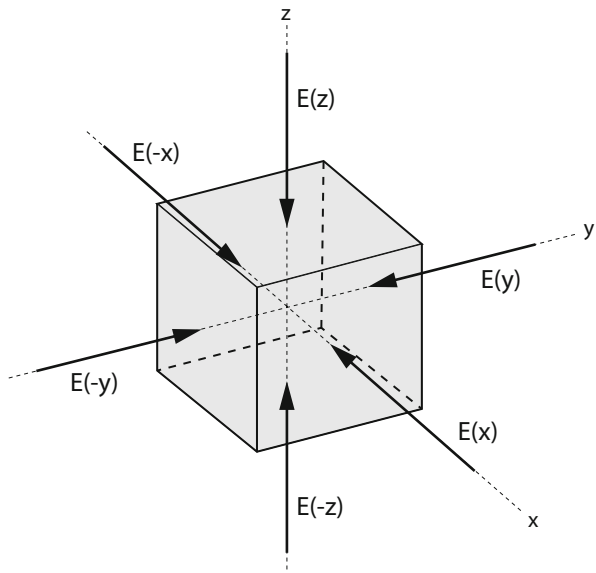
$E(z)$ and $E(-z)$ are two opposing illuminances on the z -axis

$'E(x) = E(x) - E(-x)$ is the magnitude of the illumination vector in the x -axis

$'E(y) = E(y) - E(-y)$ is the magnitude of the illumination vector in the y -axis

$'E(z) = E(z) - E(-z)$ is the magnitude of the illumination vector in the z -axis

Fig. E.1 Cubic illumination at a point



$$|E| = \sqrt{{}'E(x)^2 + {}'E(y)^2 + {}'E(z)^2}$$

with

$|E|$ is the magnitude of the illumination vector (as a result of all light incidences)

$$e(x) = {}'E(x) / |E| \quad e(y) = {}'E(y) / |E| \quad e(z) = {}'E(z) / |E|$$

with

$e(x, y, z)$ the direction of the illumination vector in the x, y, z coordinating system

$\sim E(x)$ is the lesser of $E(x)$ and $E(-x)$

$\sim E(y)$ is the lesser of $E(y)$ and $E(-y)$

$\sim E(z)$ is the lesser of $E(z)$ and $E(-z)$

$$\text{Esr} = \frac{|E|}{4} + \frac{\sim E(x) + \sim E(y) + \sim E(z)}{3}$$

with

Esr is the scalar illumination

$$E_{\text{vector}}/E_{\text{scalar}} \text{ ratio} = \frac{|E|}{\text{Esr}}$$

Appendix F: Position Indices, p

Position indices, p , are needed for the calculation of UGR. The parameters x , y and h' refer to the rectangular coordinating system shown in Fig. 4.22 (CIE 1995)

| | | | | | | | | | | | | | | | | | | | | |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| h/y | 0.00 | 0.10 | 0.20 | 0.30 | 0.40 | 0.50 | 0.60 | 0.70 | 0.80 | 0.90 | 1.00 | 1.10 | 1.20 | 1.30 | 1.40 | 1.50 | 1.60 | 1.70 | 1.80 | 1.90 |
| x/y | 0.00 | 1.00 | 1.26 | 1.53 | 1.90 | 2.35 | 2.86 | 3.50 | 4.20 | 5.00 | 6.00 | 7.00 | 8.10 | 9.25 | 10.35 | 11.70 | 13.15 | 14.70 | 16.20 | |
| | 0.10 | 1.05 | 1.22 | 1.46 | 1.80 | 2.20 | 2.75 | 3.40 | 4.10 | 4.80 | 5.80 | 6.80 | 8.00 | 9.10 | 10.30 | 11.60 | 13.00 | 14.60 | 16.10 | |
| | 0.20 | 1.12 | 1.30 | 1.50 | 1.80 | 2.20 | 2.66 | 3.18 | 3.88 | 4.60 | 5.50 | 6.50 | 7.60 | 8.75 | 9.85 | 11.20 | 12.70 | 14.00 | 15.70 | |
| | 0.30 | 1.22 | 1.38 | 1.60 | 1.87 | 2.25 | 2.70 | 3.25 | 3.90 | 4.60 | 5.45 | 6.45 | 7.40 | 8.40 | 9.50 | 10.85 | 12.10 | 13.70 | 15.00 | |
| | 0.40 | 1.32 | 1.47 | 1.70 | 1.96 | 2.35 | 2.80 | 3.30 | 3.90 | 4.60 | 5.40 | 6.40 | 7.30 | 8.30 | 9.40 | 10.60 | 11.90 | 13.20 | 14.60 | 16.00 |
| | 0.50 | 1.43 | 1.60 | 1.82 | 2.10 | 2.48 | 2.91 | 3.40 | 3.98 | 4.70 | 5.50 | 6.40 | 7.30 | 8.30 | 9.40 | 10.50 | 11.75 | 13.00 | 14.40 | 15.70 |
| | 0.60 | 1.55 | 1.72 | 1.98 | 2.30 | 2.65 | 3.10 | 3.60 | 4.10 | 4.80 | 5.50 | 6.40 | 7.35 | 8.40 | 9.40 | 10.50 | 11.70 | 13.00 | 14.10 | 15.40 |
| | 0.70 | 1.70 | 1.88 | 2.12 | 2.48 | 2.87 | 3.30 | 3.78 | 4.30 | 4.88 | 5.60 | 6.60 | 7.40 | 8.50 | 9.50 | 10.50 | 11.70 | 12.85 | 14.00 | 15.20 |
| | 0.80 | 1.82 | 2.00 | 2.32 | 2.70 | 3.08 | 3.50 | 3.92 | 4.50 | 5.10 | 5.75 | 6.60 | 7.50 | 8.60 | 9.50 | 10.60 | 11.75 | 12.80 | 14.00 | 16.10 |
| | 0.90 | 1.95 | 2.20 | 2.54 | 2.90 | 3.30 | 3.70 | 4.20 | 4.75 | 5.30 | 6.00 | 6.75 | 7.70 | 8.70 | 9.65 | 10.75 | 11.80 | 12.90 | 14.00 | 15.00 |
| | 1.00 | 2.11 | 2.40 | 2.75 | 3.10 | 3.50 | 3.91 | 4.40 | 5.00 | 5.60 | 6.20 | 7.00 | 7.90 | 8.80 | 9.75 | 10.80 | 11.90 | 12.95 | 14.00 | 16.00 |
| | 1.1 | 2.30 | 2.55 | 2.92 | 3.30 | 3.72 | 4.20 | 4.70 | 5.25 | 5.80 | 6.55 | 7.20 | 7.16 | 9.00 | 9.90 | 10.95 | 12.00 | 13.00 | 14.00 | 16.00 |
| | 1.20 | 2.40 | 2.75 | 3.12 | 3.50 | 3.90 | 4.35 | 4.85 | 5.50 | 6.05 | 6.70 | 7.50 | 8.30 | 9.20 | 10.00 | 11.02 | 12.10 | 13.10 | 14.00 | 16.00 |
| | 1.30 | 2.55 | 2.90 | 3.30 | 3.70 | 4.20 | 4.65 | 5.20 | 5.70 | 6.30 | 7.00 | 7.70 | 8.55 | 9.35 | 10.20 | 11.20 | 12.25 | 13.20 | 14.00 | 16.00 |
| | 1.40 | 2.70 | 3.10 | 3.50 | 3.90 | 4.35 | 4.85 | 5.35 | 5.85 | 6.50 | 7.25 | 8.00 | 8.70 | 9.50 | 10.40 | 11.4 | 12.40 | 13.25 | 14.05 | 16.00 |
| | 1.50 | 2.85 | 3.15 | 3.65 | 4.10 | 4.55 | 5.00 | 5.50 | 6.20 | 6.80 | 7.50 | 8.20 | 8.85 | 9.70 | 10.55 | 11.50 | 12.50 | 13.30 | 14.05 | 16.00 |
| | 1.60 | 2.95 | 3.40 | 3.80 | 4.25 | 4.75 | 5.20 | 5.75 | 6.30 | 7.00 | 7.65 | 8.40 | 9.00 | 9.80 | 10.80 | 11.75 | 12.60 | 13.40 | 14.20 | 16.00 |
| | 1.70 | 3.10 | 3.55 | 4.00 | 4.50 | 4.90 | 5.40 | 5.95 | 6.50 | 7.20 | 7.80 | 8.50 | 9.20 | 10.00 | 10.85 | 11.85 | 12.75 | 13.45 | 14.20 | 16.00 |
| | 1.80 | 3.25 | 3.70 | 4.20 | 4.65 | 5.10 | 5.60 | 6.10 | 6.75 | 7.40 | 8.00 | 8.65 | 9.35 | 10.10 | 11.00 | 11.90 | 12.80 | 13.50 | 14.20 | 16.00 |

| | | | | | | | | | | | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1.90 | 3.43 | 3.86 | 4.30 | 4.75 | 5.20 | 5.70 | 6.30 | 6.90 | 7.50 | 8.17 | 8.80 | 9.50 | 10.20 | 11.00 | 12.00 | 12.82 | 13.55 | 14.20 | 15.10 | 16.00 |
| 2.00 | 3.50 | 4.00 | 4.50 | 4.90 | 5.35 | 5.80 | 6.40 | 7.10 | 7.70 | 8.30 | 8.90 | 9.60 | 10.40 | 11.10 | 12.00 | 12.85 | 13.60 | 14.30 | 15.10 | 16.00 |
| 2.10 | 3.60 | 4.17 | 4.65 | 5.05 | 5.50 | 6.00 | 6.60 | 7.20 | 7.82 | 8.45 | 9.00 | 9.75 | 10.50 | 11.20 | 12.10 | 12.90 | 13.70 | 14.35 | 15.10 | 16.00 |
| 2.20 | 3.75 | 4.25 | 4.72 | 5.20 | 5.60 | 6.10 | 6.70 | 7.35 | 8.00 | 8.55 | 9.15 | 9.85 | 10.60 | 11.30 | 12.10 | 12.90 | 13.70 | 14.40 | 15.15 | 16.00 |
| 2.30 | 3.85 | 4.35 | 4.80 | 5.25 | 5.70 | 6.22 | 6.80 | 7.40 | 8.10 | 8.65 | 9.30 | 9.90 | 10.70 | 11.40 | 12.20 | 12.95 | 13.70 | 14.40 | 15.20 | 16.00 |
| 2.40 | 3.95 | 4.40 | 4.90 | 5.35 | 5.80 | 6.30 | 6.90 | 7.50 | 8.20 | 8.80 | 9.40 | 10.00 | 10.80 | 11.50 | 12.25 | 13.00 | 13.75 | 14.45 | 15.20 | 16.00 |
| 2.50 | 4.00 | 4.50 | 4.95 | 5.40 | 5.85 | 6.40 | 6.95 | 7.55 | 8.25 | 8.85 | 9.50 | 10.05 | 10.85 | 11.55 | 12.30 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |
| 2.60 | 4.07 | 4.55 | 5.05 | 5.47 | 5.95 | 6.45 | 7.00 | 7.65 | 8.35 | 8.95 | 9.65 | 10.10 | 10.90 | 11.60 | 12.32 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |
| 2.70 | 4.10 | 4.60 | 5.10 | 5.53 | 6.00 | 6.50 | 7.05 | 7.70 | 8.40 | 9.00 | 9.60 | 10.16 | 10.92 | 11.63 | 12.35 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |
| 2.80 | 4.15 | 4.62 | 5.15 | 5.56 | 6.05 | 6.55 | 7.08 | 7.73 | 8.45 | 9.05 | 9.65 | 10.20 | 10.95 | 11.65 | 12.35 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |
| 2.90 | 4.20 | 4.65 | 5.17 | 5.60 | 6.07 | 6.57 | 7.12 | 7.75 | 8.50 | 9.10 | 9.70 | 10.23 | 10.95 | 11.65 | 12.35 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |
| 3.00 | 4.22 | 4.67 | 5.20 | 5.65 | 6.12 | 6.60 | 7.15 | 7.80 | 8.55 | 9.12 | 9.70 | 10.23 | 10.95 | 11.65 | 12.35 | 13.00 | 13.80 | 14.50 | 15.25 | 16.00 |

Appendix G: Groningen Sleep Quality Scale

| | | | |
|----|---|------|-------|
| 1 | I had a deep sleep last night | True | False |
| 2 | I feel like I slept poorly last night | True | False |
| 3 | It took me more than half an hour to fall asleep last night | True | False |
| 4 | I felt tired after waking up this morning | True | False |
| 5 | I woke up several times last night | True | False |
| 6 | I feel like I didn't get enough sleep last night | True | False |
| 7 | I got up in the middle of the night | True | False |
| 8 | I felt rested after waking up this morning | True | False |
| 9 | I feel like I only had a couple of hours of sleep last night | True | False |
| 10 | I feel I slept well last night | True | False |
| 11 | I didn't sleep a wink last night | True | False |
| 12 | I didn't have any trouble falling asleep last night | True | False |
| 13 | After I woke up last night, I have trouble falling asleep again | True | False |
| 14 | I tossed and turned all night last night | True | False |
| 15 | I didn't get more than 5 h of sleep last night | True | False |

Scoring:

The first question doesn't count towards the total score

One point if answer is "True" for questions 2, 3, 4, 5, 6, 7, 9, 11, 13, 14, 15

One point if answer is "false" for questions 8, 10, 12

Maximum score of 14 points indicates poor sleep the night before

Note: The Groningen Sleep Quality Scale (Meijman et al. 1988) is a tool that can be used to understand your patterns in overall sleep quality. Answer these 15 questions for at least 14 days in a row to help understand your individual sleep patterns

Appendix H: Normalised Formula for SVM according to CIE (2016)

$$\text{SVM} = \sqrt[3.7]{\sum \left(\frac{C_i}{T_i}\right)^{3.7}}$$

SVM = stroboscopic visibility measure

C_i = the amplitude of the i th Fourier component

T_i = the visibility threshold for a sine wave at the frequency of the i th Fourier component

T = 1/Stroboscopic sensitivity of Fig. 10.8

T as formula:

$$T_i(f) = \frac{1}{1 + e^{-a(f-b)}} + 20e^{-f/10}$$

f = frequency of the i th Fourier component in Hz

$a = 0.00518$

$b = 306.6$

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