

Supplementary to: Spatio-temporal
summation of perimetric stimuli in
healthy observers

Spatial summation with midget OFF retinal ganglion cells

		Eccentricity (degrees)			Comparisons		
		1.414 (A)	5.657 (B)	9.899 (C)	A vs B	A vs C	B vs C
Uncorrected	τ ($\times 10^2$)	66.53 [39.12, 110.42]	30.46 [21.03, 46.24]	15.18 [11.14, 22.68]	< 0.0001	< 0.0001	0.0002
	Offset (dB/10)	2.34 [2.28, 2.43]	2.51 [2.45, 2.6]	2.54 [2.44, 2.61]	< 0.0001	< 0.0001	0.4201
	Ricco's area (deg^2)	0.039 [0.024, 0.068]	0.109 [0.068, 0.149]	0.144 [0.104, 0.197]	< 0.0001	< 0.0001	0.0171
	# mOFF-RGCs*	95.72 [55.66, 159.1]	44.04 [30.39, 67.08]	22.02 [16.06, 32.7]	< 0.0001	< 0.0001	0.0002
Convergence weighted	τ ($\times 10^2$)	84.28 [51.02, 137.96]	71.01 [48.86, 105.18]	57.62 [43.78, 92.11]	0.9442	0.4883	0.9442
	Offset (dB/10)	2.31 [2.25, 2.41]	2.42 [2.35, 2.5]	2.4 [2.3, 2.46]	< 0.0001	0.0175	0.0403
	Ricco's area (deg^2)	0.039 [0.024, 0.068]	0.11 [0.067, 0.148]	0.143 [0.103, 0.198]	< 0.0001	< 0.0001	0.0153
	# mOFF-RGCs [†]	121.39 [72.82, 198.81]	102.5 [70.58, 152.3]	83.61 [63.67, 132.72]	0.9326	0.4854	0.9326

Table S1. Median [Interquartile Range] of the different outputs from the model fits. Comparisons were performed on log-transformed values but reported in linear scale (except for the Offset, which was tested and reported in log-scale). mOFF-RGC = midget OFF retinal ganglion cells. *Obtained by taking the product of Ricco's area and local mOFF-RGC density; [†] Obtained by taking the product of Ricco's area and local mOFF-RGC density scaled by retinal convergence.

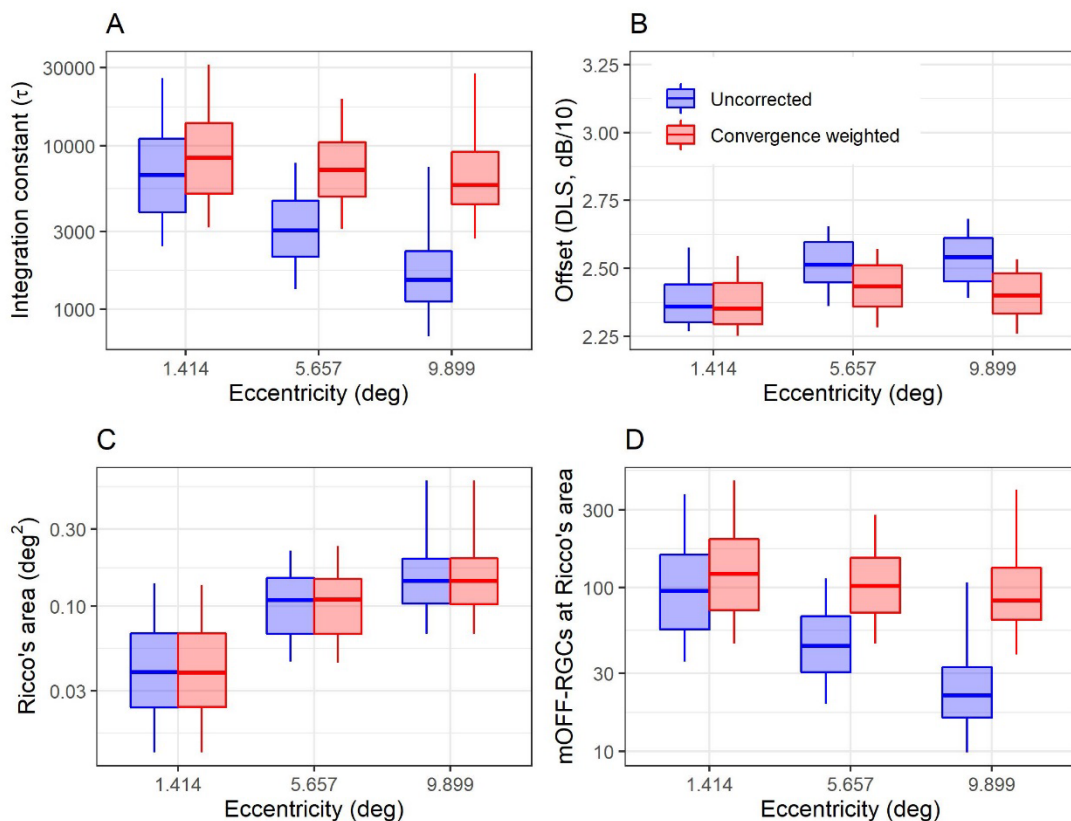


Figure S1. Box-plots of the different parameters and estimates derived from the model for spatial summation data. Note that the convergence weighted values in **(D)** are obtained by simply multiplying the uncorrected number of midget OFF-RGCs at Ricco's area by the convergence rate. The box encloses the interquartile range, the horizontal midline indicates the median and the error bars extend from the 5% to the 95% quantiles. The vertical axis is \log_{10} -spaced. RGC = Retinal Ganglion Cell

Effect of optical factor compensation

		Eccentricity (degrees)			Comparisons		
		1.414 (A)	5.657 (B)	9.899 (C)	A vs B	A vs C	B vs C
Uncorrected	τ ($\times 10^2$)	72.54 [42.4, 119.38]	53.5 [36.78, 86.51]	32.35 [22.6, 53.44]	0.1386	0.0006	0.0413
	Offset (dB/10)	2.33 [2.28, 2.43]	2.49 [2.43, 2.59]	2.5 [2.41, 2.58]	< 0.0001	< 0.0001	0.8806
	Ricco's area (deg^2)	0.019 [0.011, 0.037]	0.101 [0.059, 0.139]	0.143 [0.091, 0.219]	< 0.0001	< 0.0001	0.0017
	# P-OFF-RGCs*	9.46 [5.17, 16.99]	11.5 [7.59, 20.01]	9.02 [6.05, 15.54]	0.5253	0.8895	0.8895
Convergence weighted	τ ($\times 10^2$)	90.12 [54.7, 148.87]	124.47 [85.97, 201.38]	126.58 [83.64, 210]	0.0324	0.0071	0.5050
	Offset (dB/10)	2.31 [2.25, 2.41]	2.4 [2.34, 2.5]	2.36 [2.27, 2.43]	0.0006	0.2574	0.0163
	Ricco's area (deg^2)	0.019 [0.011, 0.037]	0.101 [0.058, 0.14]	0.143 [0.094, 0.207]	< 0.0001	< 0.0001	0.0020
	# P-OFF-RGCs [†]	64.77 [36.86, 116.88]	85.95 [57.42, 150.81]	84.08 [53.29, 145.9]	0.1166	0.0701	0.7000

Table S2. Median [Interquartile Range] of the different outputs from the model fits by taking the summation over the module (absolute value) of the RGC. Comparisons were performed on log-transformed values but reported in linear scale (except for the Offset, which was tested and reported in log-scale). P-OFF-RGC = parasol OFF retinal ganglion cells. *Obtained by taking the product of Ricco's area and local, P-OFF-RGC density; [†] Obtained by taking the product of Ricco's area and local P-OFF-RGC density scaled by retinal convergence.

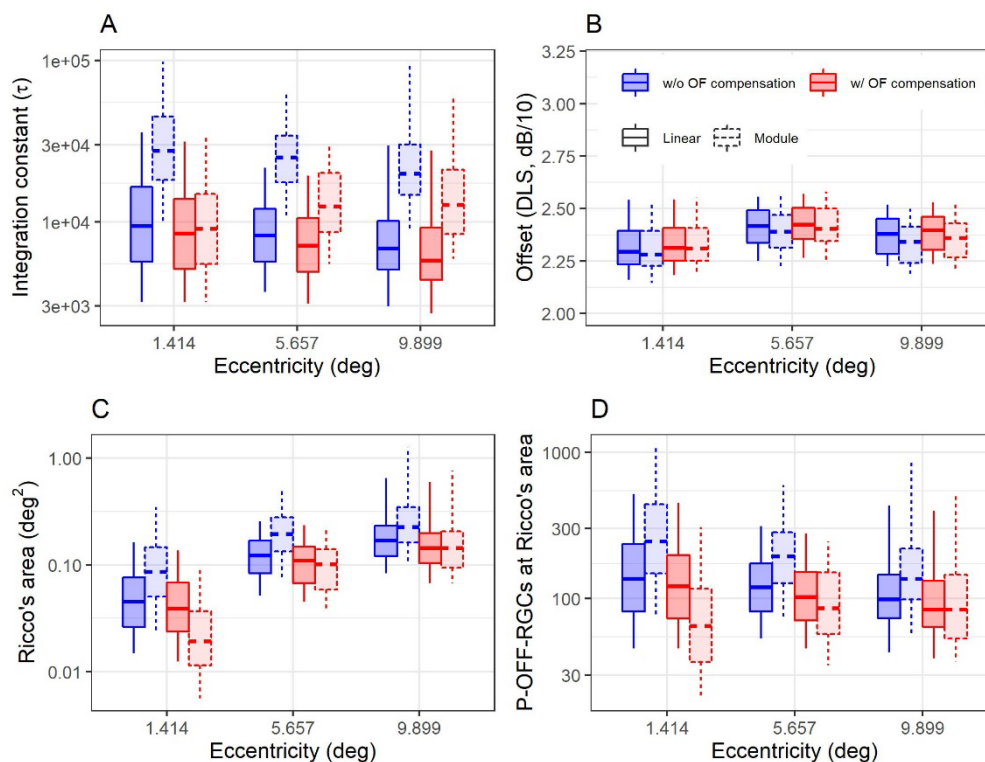


Figure S2. Box-plots of the different parameters and estimates derived from the model for spatial summation data. The shading indicates whether the summation in Equation (6) in the text was taken over the absolute value (module) or the signed (linear) RGC input. The box encloses the interquartile range, the horizontal midline indicates the median and the error bars extend from the 5% to the 95% quantiles. The vertical axis is \log_{10} -spaced. RGC = Retinal Ganglion Cell; OF = Optical factors (average modulation transfer function of the eye)

Average parameters for the psychometric functions

Stimulus	Location {X, Y}	μ, σ (dB)				
		Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
G-I, 15 ms	{-7, -7}	13.99, 1.86	17.52, 1.79	15.43, 2.06	12.68, 2.90	12.79, 2.97
	{-7, 7}	13.22, 1.66	13.59, 5.15	14.41, 1.92	12.17, 4.89	10.46, 3.41
	{7, -7}	15.55, 2.54	16.88, 3.45	15.48, 1.58	12.60, 2.00	9.16, 3.94
	{7, 7}	15.72, 2.58	14.95, 4.12	15.52, 1.72	12.35, 1.75	13.08, 3.09
G-I, 200 ms	{-7, -7}	21.90, 1.86	24.35, 1.4	22.67, 2.10	22.46, 1.53	20.97, 3.73
	{-7, 7}	20.63, 1.82	23.24, 2.03	22.56, 2.18	22.80, 2.36	20.03, 3.99
	{7, -7}	24.54, 1.59	24.70, 1.67	23.32, 1.76	22.90, 2.29	20.03, 3.13
	{7, 7}	25.96, 1.73	23.92, 1.63	23.68, 2.02	22.69, 2.20	22.28, 2.12
G-V, 15 ms	{-7, -7}	31.69, 1.75	34.09, 1.24	32.87, 1.44	32.49, 1.88	32.86, 1.33
	{-7, 7}	31.34, 1.04	33.06, 1.32	31.91, 2.20	32.30, 1.77	31.56, 1.18
	{7, -7}	33.47, 1.17	33.86, 1.61	32.56, 1.35	32.12, 2.11	32.90, 1.68
	{7, 7}	33.37, 1.43	34.12, 0.99	32.57, 1.44	32.00, 2.03	32.67, 1.28
G-V, 200 ms	{-7, -7}	36.81, 0.94	38.31, 0.85	37.61, 1.70	38.21, 1.00	37.49, 1.13
	{-7, 7}	36.96, 1.21	37.33, 0.96	37.20, 1.45	38.15, 1.84	37.11, 0.90
	{7, -7}	38.23, 0.77	38.57, 1.27	37.80, 1.96	37.75, 1.74	37.05, 0.92
	{7, 7}	38.13, 1.05	38.41, 0.61	37.80, 1.44	38.14, 0.87	37.17, 0.99
	γ	0.018	0.024	0.009	0.055	0.063
	λ	0.017	0.008	0.016	0.039	0.008

Supplementary Table 1. Fitted parameters for the psychometric function obtained from the Method of Constant Stimuli (MOCS) experiment at the four tested locations in five subjects with four different combinations of stimulus size and duration. Lapses (λ) and guesses (γ) were modelled as global parameters for the whole MOCS experiment in each eye.

Results with an alternative temporal impulse response

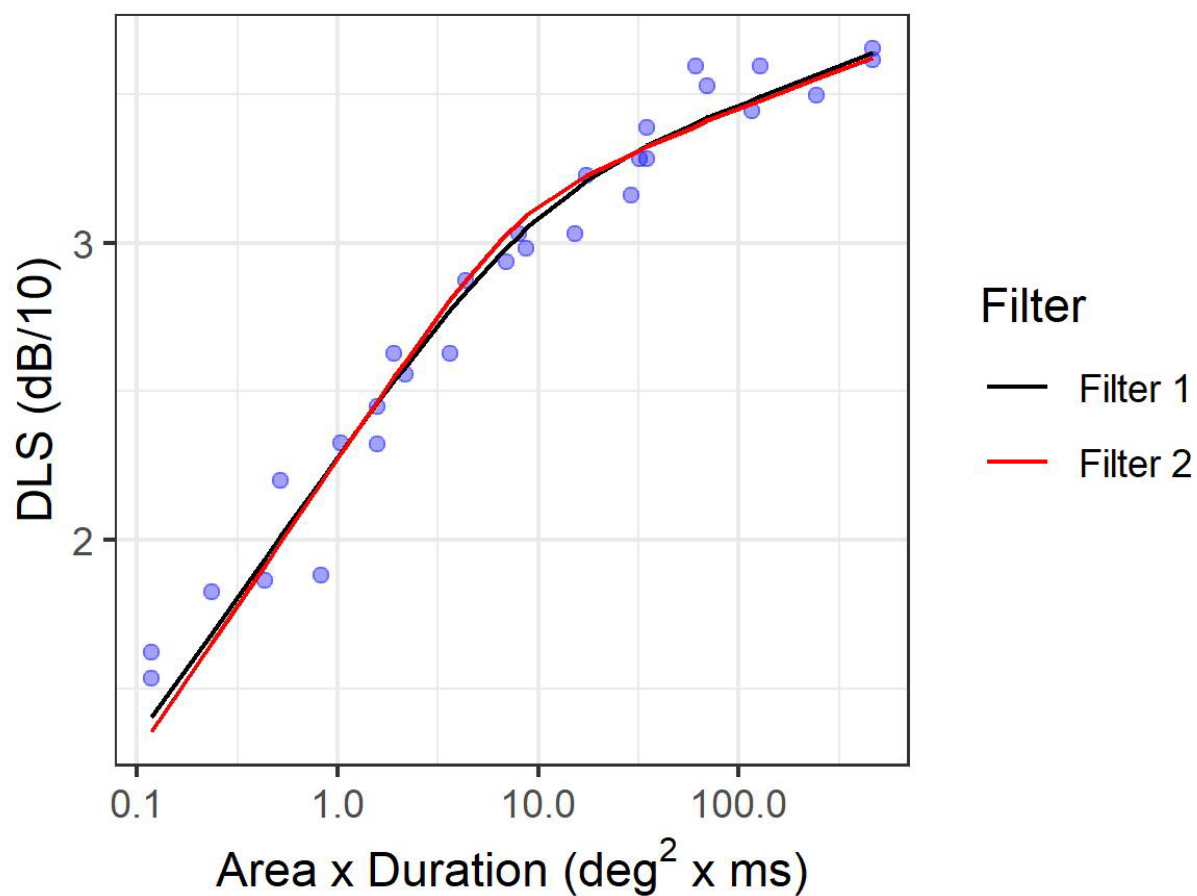


Figure S3. Example of the fitted response of the model with the impulse response used in the main calculations (Filter 1) and with the monophasic impulse response used by Gorea and Tyler¹ and described by Watson² (Filter 2)

References

1. Gorea A, Tyler CW. New look at Bloch's law for contrast. *J Opt Soc Am A* 1986;3(1):52-61.
2. Watson AB. Derivation of the impulse response: comments on the method of Roufs and Blommaert. *Vision Res* 1982;22(10):1335-7.