Feb. 24, 2009

Corrections to Graham, N. and Sutter, A. (2000) Normalization: Contrast-gain control in simple (Fourier) and complex (non-Fourier) pathways of pattern vision. *Vision Research*, 40, 2737-2761.

A. MISTAKE IN EQN (2) OF GRAHAM AND SUTTER (2000)

In equation (2) of the appendix, the pair of curly brackets should have been vertical lines to indicate absolute value. That is, the equation should have read

$D_x = R_x = w_x \cdot | A_1 \cdot |C_1|^{km} - A_2 \cdot |C_2|^{km} |$

B. INCONSISTENCY BETWEEN PREDICTIONS SHOWN IN FIG. 14 AND THE FORM OF EQUATIONS PRESENTED IN THE APPENDIX OF GRAHAM AND SUTTER (2000)

Predictions like those in Fig. 14 can be generated from the model equations as given in the appendix of this paper. Regrettably, however, those in Fig. 14 were not.

See page 2 of this pdf for an example set of predictions like those in Fig. 14 but done with the equations from the appendix.

The predictions shown in Fig. 14 were generated by a different form of the model equations. See pages 3 to 6 of this pdf if you wish to see the exact equations and parameters used to generate the predictions in Fig. 14.

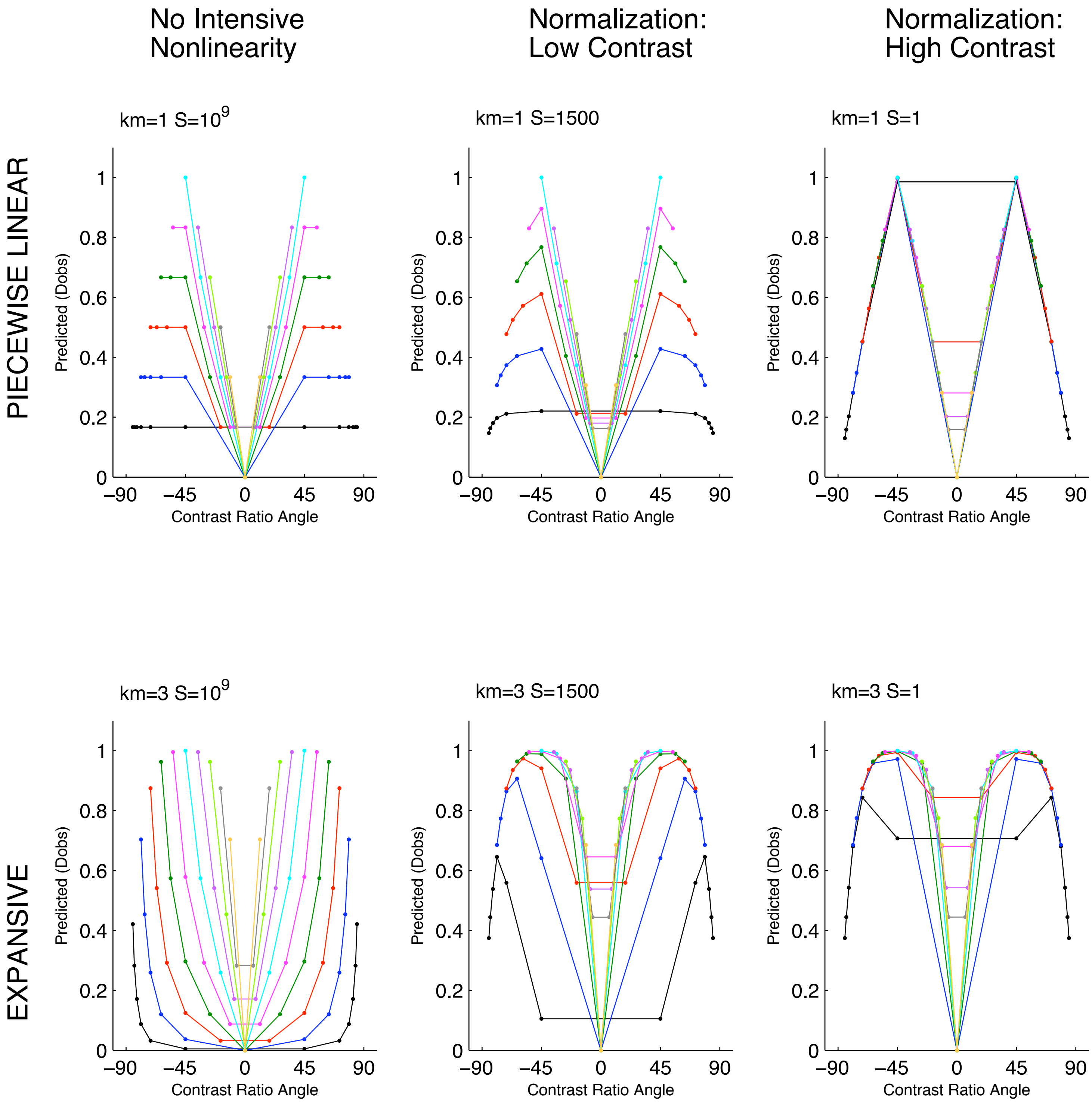
We thank Stephanie Pan for having discovered this error, tracked down its source, and for producing pages 2 through 6 of this pdf.

09–Nov–2007

Predictions from equations from the appendix of GS2000.

C1 values = C2 values = –6,–5,–4,...0,...,+4,+5,+6

ws=0 wx=1 wos=4 wox=4 A1=A2=1 ksp=kd=kn=2



Equations that generated predictions in Fig. 14 of Graham & Sutter 2000.

$$\text{SimpleCh} = \left| (w_{sm} \cdot DR2 \cdot A2 \cdot Area2) - (w_{sm} \cdot DR1 \cdot A1 \cdot Area1) \right|$$

$$\boxed{\begin{aligned} DR1 &= \pm 1.5, \pm 1.25, \pm 1.00, \ldots, \pm 0.25, 0 \\ DR2 &= \pm 1.5, \pm 1.25, \pm 1.00, \ldots, \pm 0.25, 0 \\ A1 &= Area1 = A2 = Area2 = 1 \\ w_{sm} &= 0 \\ w_{cx} &= 1 \end{aligned}}$$

$$= \left| [(0) \cdot DR2 \cdot (1) \cdot (1)] - [(0) \cdot DR1 \cdot (1) \cdot (1)] \right|$$

$$= 0$$

$$\text{SumN} = \text{SumN} + (\text{SimpleCh})^{kchn}$$
$$= 0 + 0^2$$
$$= 0$$

$$\boxed{\begin{aligned} kchn &= 2 \\ kchd &= 2 \end{aligned}}$$

$$\text{SimpleN} = (\text{SumN})^{\frac{1}{kchn}}$$
$$= 0^{1/2}$$
$$= 0$$

$$\text{SumD} = \text{SumD} + (\text{SimpleCh})^{kchd}$$
$$= 0 + 0^2$$
$$= 0$$

$$\text{SimpleD} = (\text{SumD})^{\frac{1}{kchd}}$$
$$= 0^{\frac{1}{2}}$$
$$= 0$$

$$\boxed{\begin{aligned} kmdd &= 1 \\ kmu &= 1 \end{aligned}}$$

kmdd and kmu select among the 3 variants of complex channel from pg. 256 of Graham-Sutter 1998. This choice selects the model in the main text (version 1 of pg. 256). This is the ordinary form of complex channel and is the form used in Graham & Sutter 2000.

$$\boxed{kmd = \begin{cases} 1 \\ 3 \end{cases}}$$ intermediate nonlinearity exponent

$$ComplexCh = \left| \left\{ \left| (w_{cx} \cdot DR2)^{kmd} \cdot A2 \cdot Area2 \right|^{\frac{1}{kmu}} - \left| (w_{cx} \cdot DR1)^{kmd} \cdot A1 \cdot Area1 \right|^{\frac{1}{kmu}} \right\} \right|^{\frac{1}{kmdd}}$$

$$= \left| \left\{ \left| [(1) \cdot DR2]^{kmd} \cdot (1) \cdot (1) \right|^{(\frac{1}{1})} - \left| [(1) \cdot DR1]^{kmd} \cdot (1) \cdot (1) \right|^{(\frac{1}{1})} \right\} \right|^{(\frac{1}{1})}$$

$$= \left| \left| DR2^{kmd} \right| - \left| DR1^{kmd} \right| \right|$$

$$SumN = SumN + (ComplexCh)^{kchn}$$

$$= \sum_{i=1}^{1} (ComplexCh)_i^2$$

$$= (ComplexCh)^2$$

$$ComplexN = (SumN)^{\frac{1}{2}}$$

$$= ComplexCh$$

similarly for SumD and ComplexD, so that

$$ComplexD = ComplexCh$$

$$OtherSmCh = \left\{ \left| w_{os} \cdot DR2 \right|^{kspn} + \left| w_{os} \cdot DR1 \right|^{kspn} \right\}^{\frac{1}{kspn}}$$

$$= \left\{ \left| 0 \cdot DR2 \right|^2 + \left| 0 \cdot DR1 \right|^2 \right\}^{\frac{1}{2}}$$

$$= 0$$

$$\boxed{\begin{array}{l} w_{os} = 0 \\ kspn = 2 \end{array}}$$

$$Sum = Sum + (OtherSmCh)^{kchn}$$

$$= 0 + 0^2$$

$$= 0$$

$$OtherSm = (Sum)^{\frac{1}{kchn}}$$

$$= 0^{\frac{1}{2}}$$

$$= 0$$

$$
\begin{aligned}
w_{oc} &= 4 \\
kmud &= \max(kmdd, kmu) \\
&= \max(1, 1) \\
&= 1
\end{aligned}
$$

$$
\begin{aligned}
OtherCxCh &= \left\{ \left| (w_{oc} \cdot DR2)^{kmd} \right|^{\frac{kspn}{kmud}} + \left| (w_{oc} \cdot DR1)^{kmd} \right|^{\frac{kspn}{kmud}} \right\}^{\frac{1}{kspn}} \\
&= \left\{ \left| (4 \cdot DR2)^{kmd} \right|^{\frac{2}{1}} + \left| (4 \cdot DR1)^{kmd} \right|^{\frac{2}{1}} \right\}^{\frac{1}{2}} \\
&= \left\{ \left| 4 \cdot DR2 \right|^{2 \cdot kmd} + \left| 4 \cdot DR1 \right|^{2 \cdot kmd} \right\}^{\frac{1}{2}}
\end{aligned}
$$

$$
\begin{aligned}
Sum &= Sum + (OtherCxCh)^{kchn} \\
&= \sum_{i=1}^{1} (OtherCxCh)_i^2 \\
&= (OtherCxCh)^2
\end{aligned}
$$

$$
\begin{aligned}
OtherCx &= (Sum)^{\frac{1}{kchn}} \\
&= \left[(OtherCxCh)^2 \right]^{\frac{1}{2}} \\
&= OtherCxCh
\end{aligned}
$$

$$
\begin{aligned}
SpPoolFact1 &= \int_0^{\pi} [\sin(t)]^{kspn} \, dt \\
&= 1.2533
\end{aligned}
$$

$$
\begin{aligned}
SimpleAndComplexPoolNorm &= (SpPoolFact1)^{kchn} \cdot \left[(SimpleN)^{kchn} + (ComplexN)^{kchn} \right] \\
&= (1.2533)^2 \cdot \left[0^2 + \left\| DR2^{kmd} \right| - \left| DR1^{kmd} \right\|^2 \right] \\
&= (1.2533)^2 \cdot \left\| DR2^{kmd} \right| - \left| DR1^{kmd} \right\|^2
\end{aligned}
$$

$$
\begin{aligned}
All &= \left[SimpleAndComplexPoolNorm + (OtherSm)^{kchn} + (OtherCx)^{kchn} \right]^{\frac{1}{kchn}} \\
&= \left[(1.2533)^2 \cdot \left\| DR2^{kmd} \right| - \left| DR1^{kmd} \right\|^2 + 0^2 + \left\{ \left\{ \left| 4 \cdot DR2 \right|^{2 \cdot kmd} + \left| 4 \cdot DR1 \right|^{2 \cdot kmd} \right\}^{\frac{1}{2}} \right\}^2 \right]^{\frac{1}{2}} \\
&= \left[(1.2533)^2 \cdot \left\| DR2^{kmd} \right| - \left| DR1^{kmd} \right\|^2 + \left\{ \left| 4 \cdot DR2 \right|^{2 \cdot kmd} + \left| 4 \cdot DR1 \right|^{2 \cdot kmd} \right\} \right]^{\frac{1}{2}}
\end{aligned}
$$

$$\text{Numerator} = \text{SpPoolFact1} \cdot \left[(\text{SimpleD})^{kchd} + (\text{ComplexD})^{kchd} \right]^{\frac{1}{kchd}}$$

$$= 1.2533 \cdot \left[0^2 + \left| |DR2^{kmd}| - |DR1^{kmd}| \right|^2 \right]^{\frac{1}{2}}$$

$$= 1.2533 \cdot \left| |DR2^{kmd}| - |DR1^{kmd}| \right|$$

$$\boxed{\text{sig} = \begin{cases} 1000 \\ 9 \\ 1 \end{cases}}$$

$$\text{Seg} = \frac{\text{Numerator}}{\text{sig} + \text{All}}$$