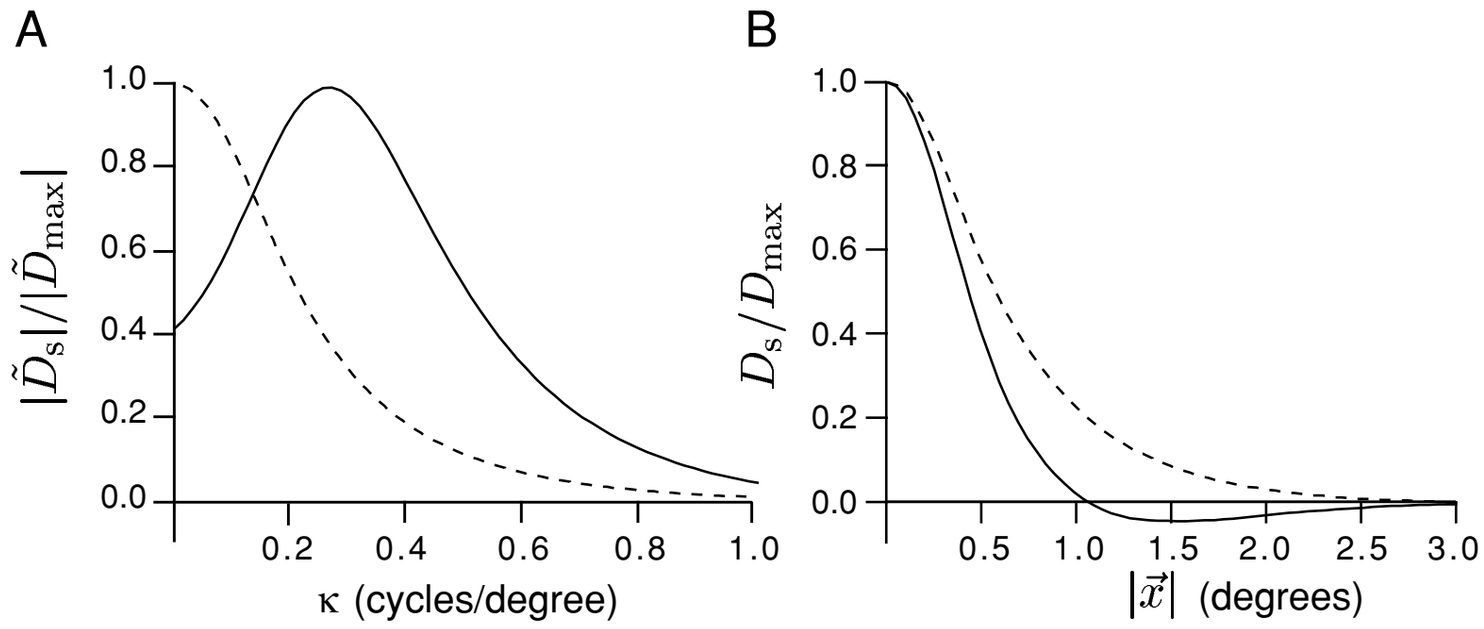
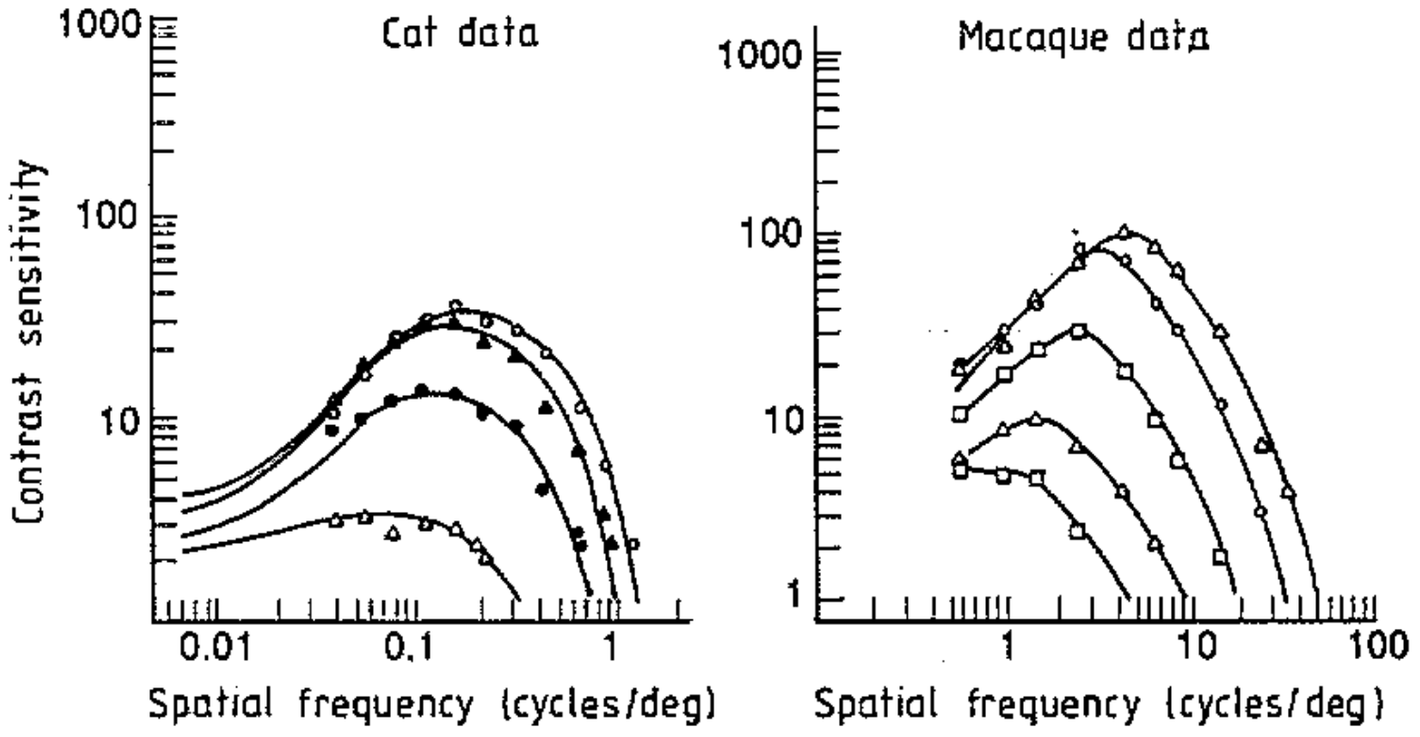
Testing efficient coding principles


A
B
1.0
0.8
0.6
0.4
0.2
0.0
$|\tilde{D}_s|/|\tilde{D}_{max}|$
0.2
0.4
0.6
0.8
1.0
κ (cycles/degree)
D_s/D_{max}
0.5
1.0
1.5
2.0
2.5
3.0
$|\vec{x}|$ (degrees)


Cat data
Macaque data
1000
100
10
1
Contrast sensitivity
0.01
0.1
1
10
100
Spatial frequency (cycles/deg)
Spatial frequency (cycles/deg)

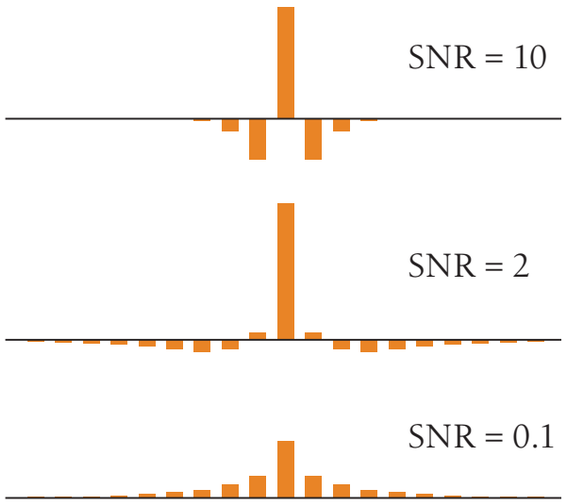
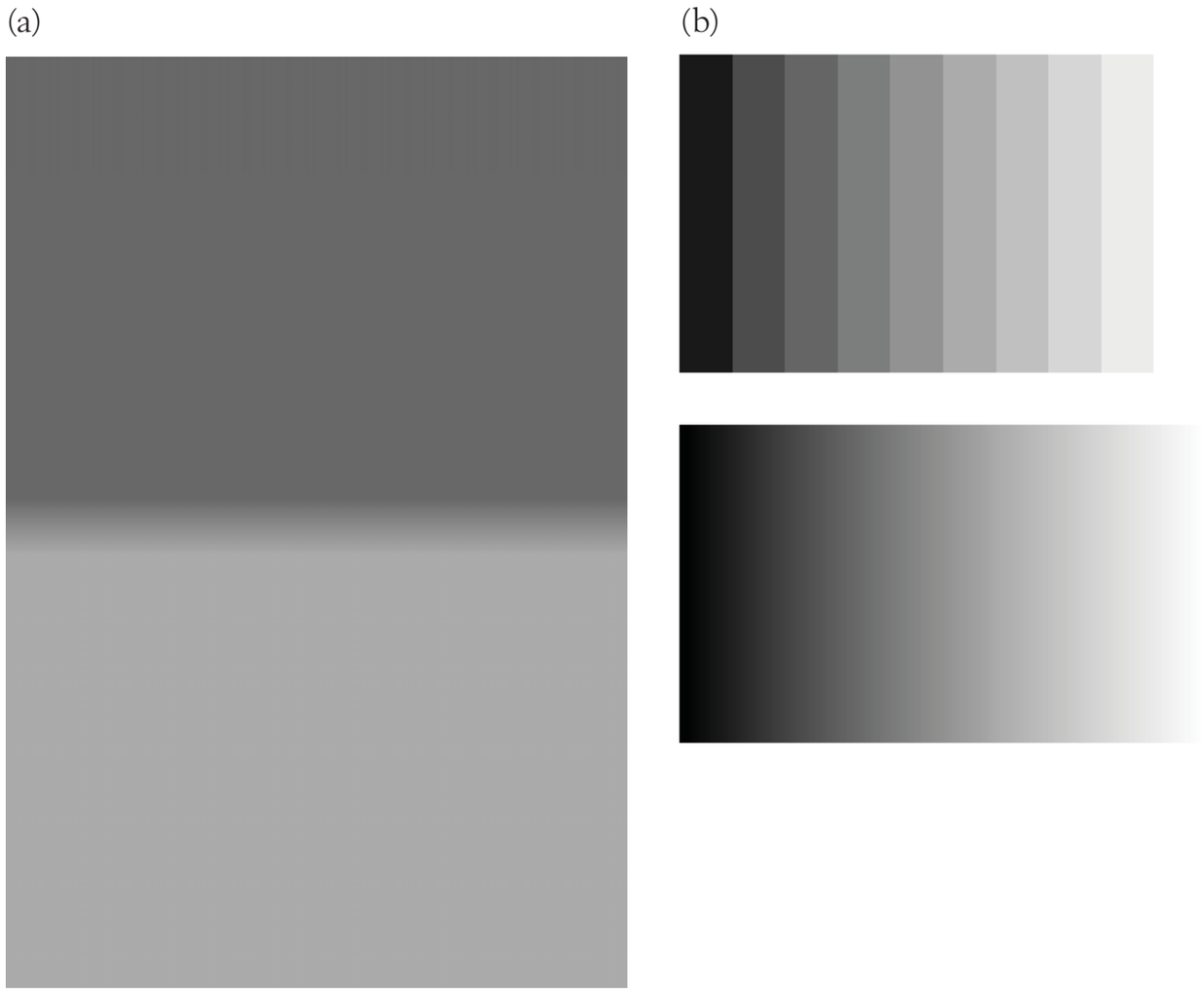
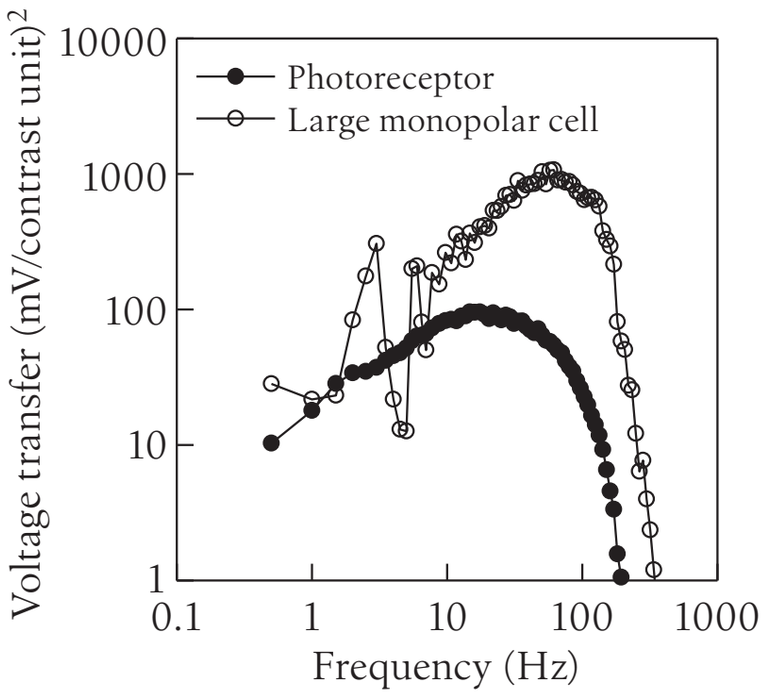


FIGURE 6.33

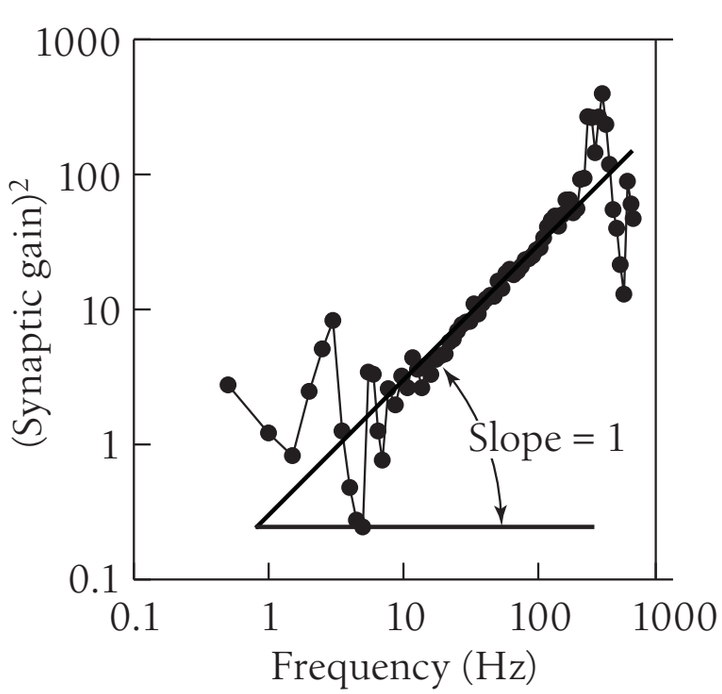
Cross-sections through the optimal matrices W_{ij} in the problem of efficient coding with noise. The correlation function is assumed to be exponential, $C_{ij} \propto \exp(-|i - j|/\xi)$, with $\xi = 50$, much longer than the range of interactions shown here. At high signal-to-noise ratios (SNRs), the solution looks like a differentiator, which removes the second-order correlations in the signal, whereas at low SNR, the solution integrates to suppress noise. Redrawn from Atick and Redlich (1990).



(a)


Photoreceptor
Large monopolar cell
Voltage transfer (mV/contrast unit)^2
10000
1000
100
10
1
0.1
1
10
100
1000
Frequency (Hz)

(b)


(Synaptic gain)^2
1000
100
10
1
0.1
Slope = 1
0.1
1
10
100
1000
Frequency (Hz)