

Advances in Visual Perception

PSYC 526

Profs. Fred Kingdom & Kathy Mullen



Lecture

Topic 2 Seeing Patterns I

Reading: Basic Vision, Ch. 4

Scale



Effects of bandpass filtering

Unfiltered



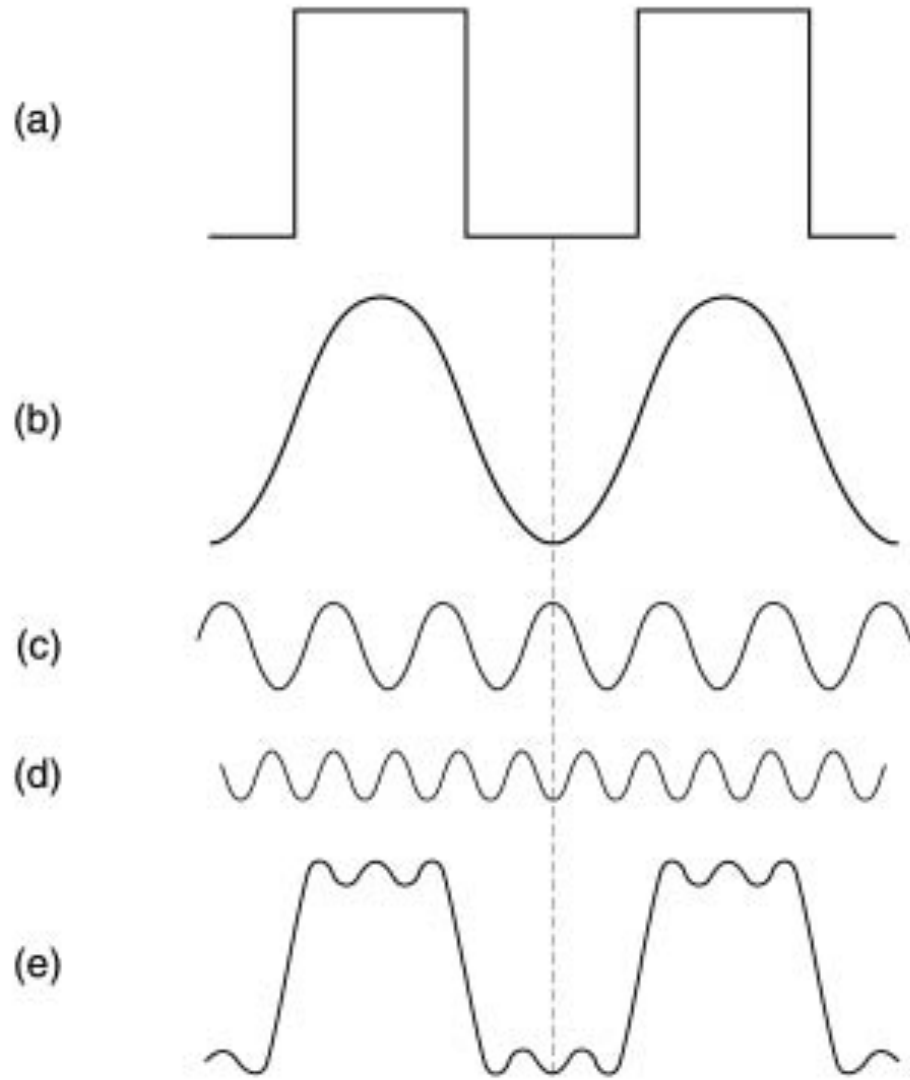
Lowpass filtered



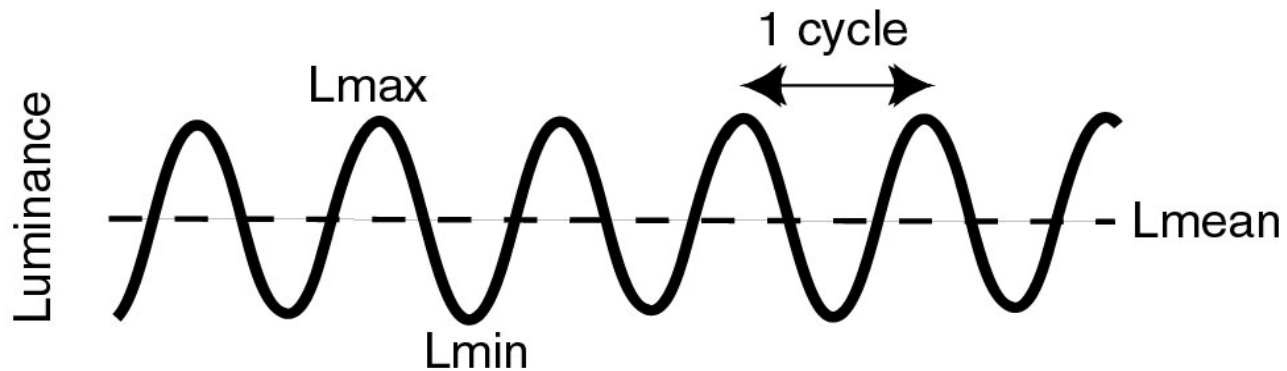
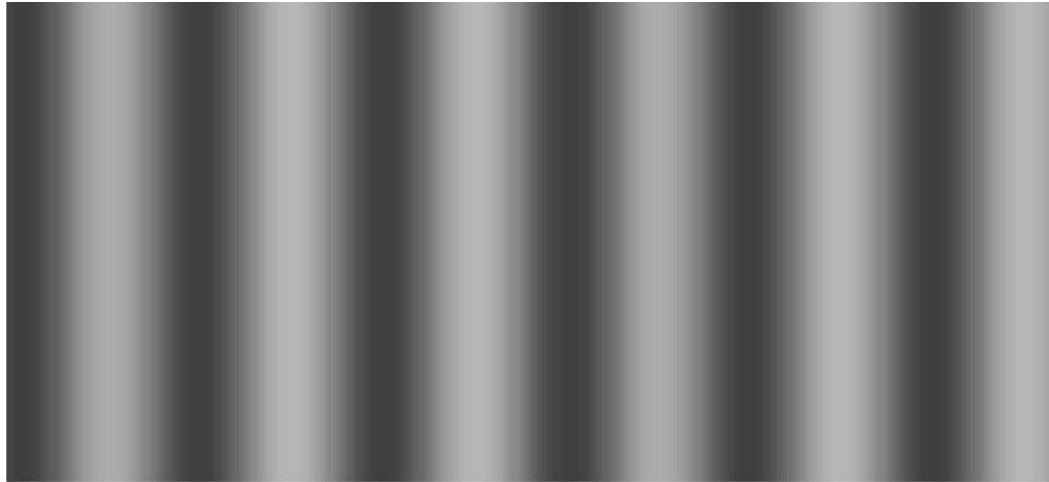
Highpass filtered



Fourier components of a square wave

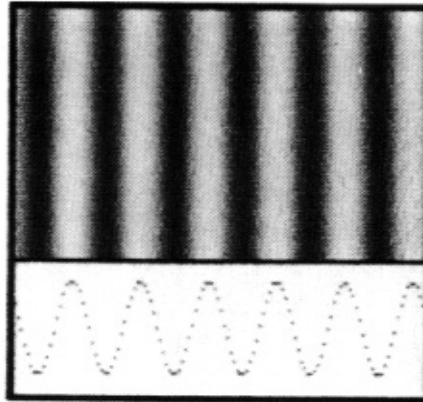


Sinewave grating

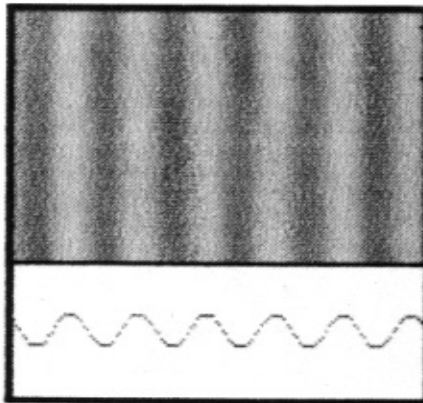


$$\text{Contrast} = (L_{\text{max}} - L_{\text{min}}) / (L_{\text{max}} + L_{\text{min}}) - L_{\text{min}}$$

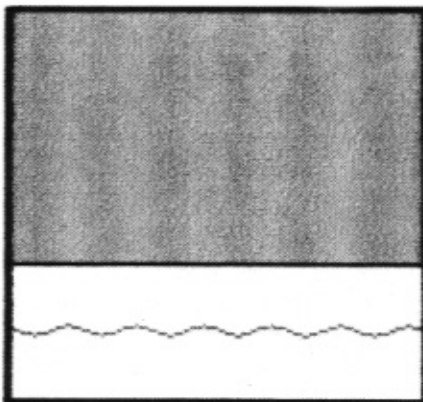
Contrast



High contrast



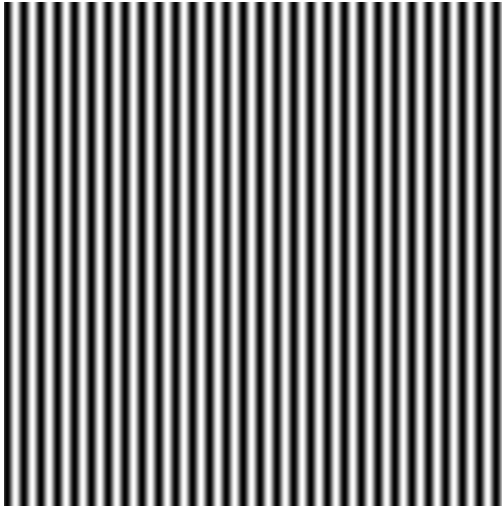
Medium contrast



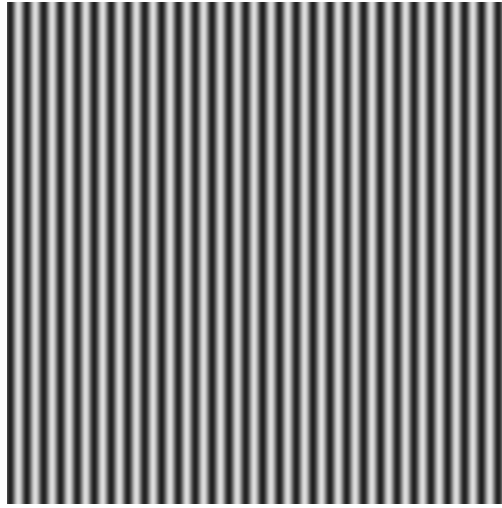
Low contrast

Contrast

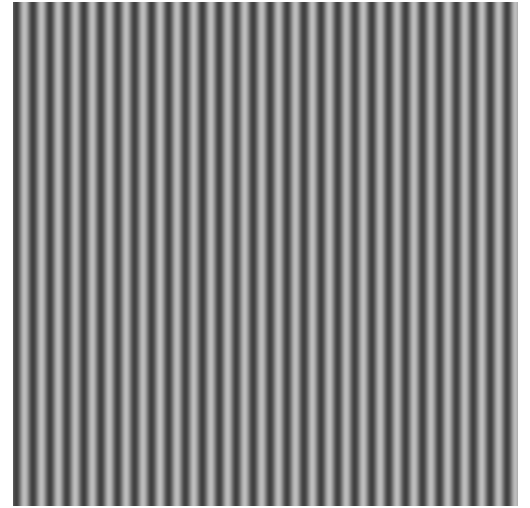
1



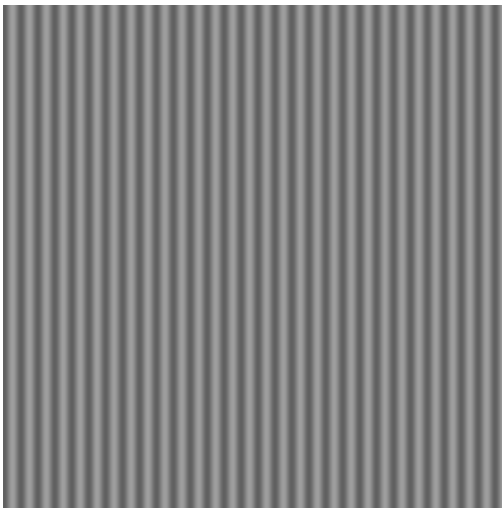
0.75



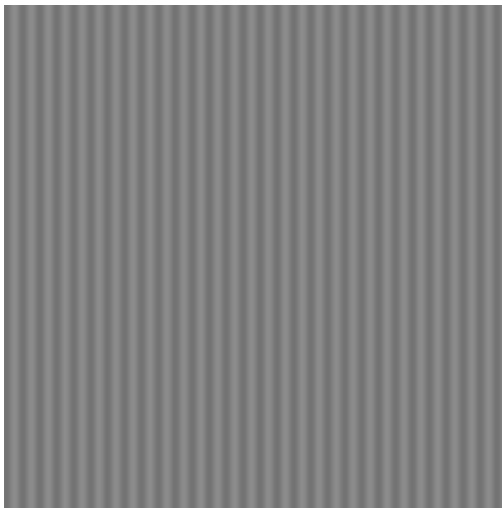
0.5



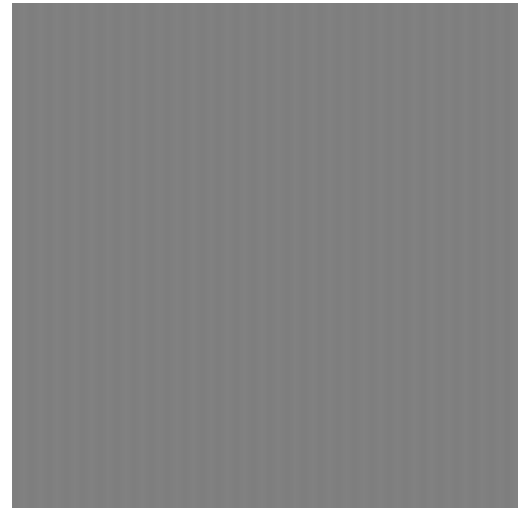
0.25



0.1



0.01

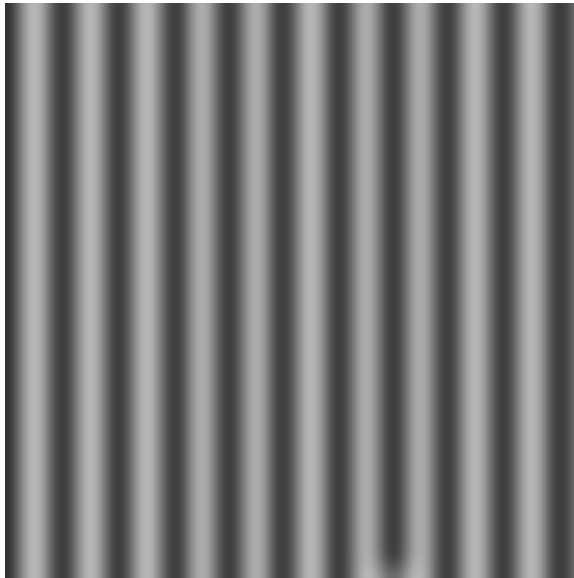


Spatial frequency (SF)

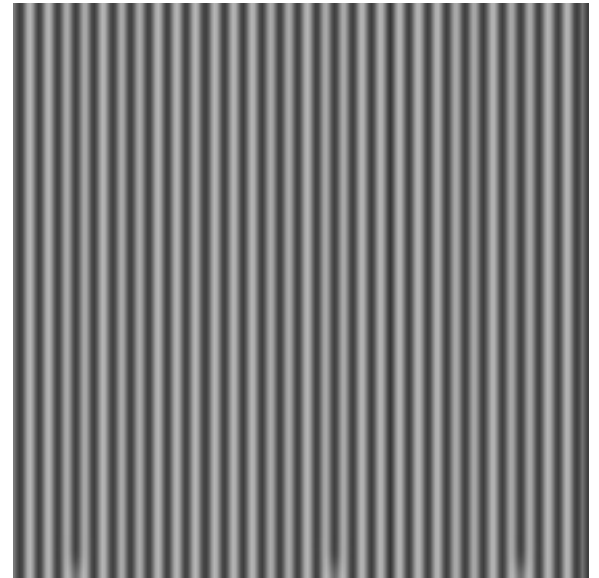
Low SF



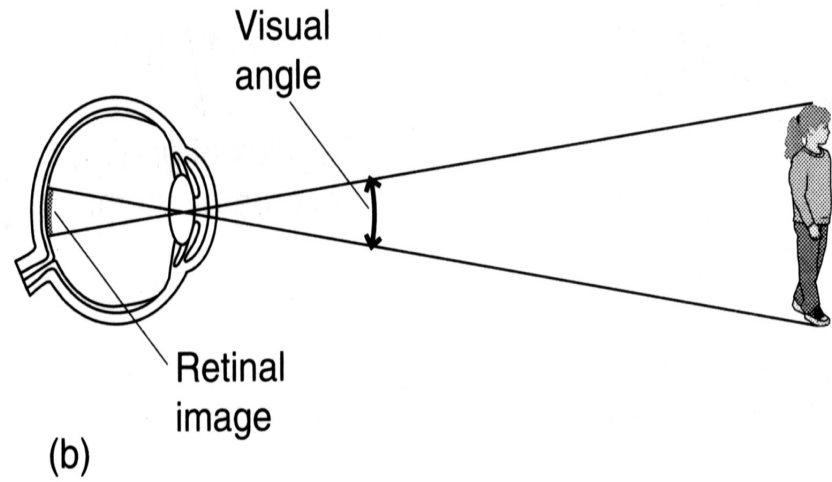
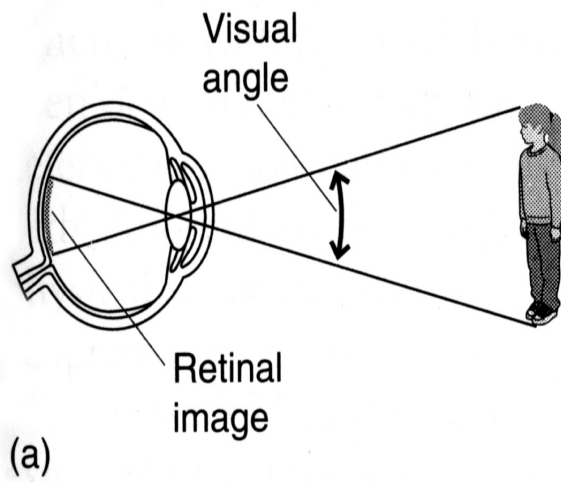
Medium SF



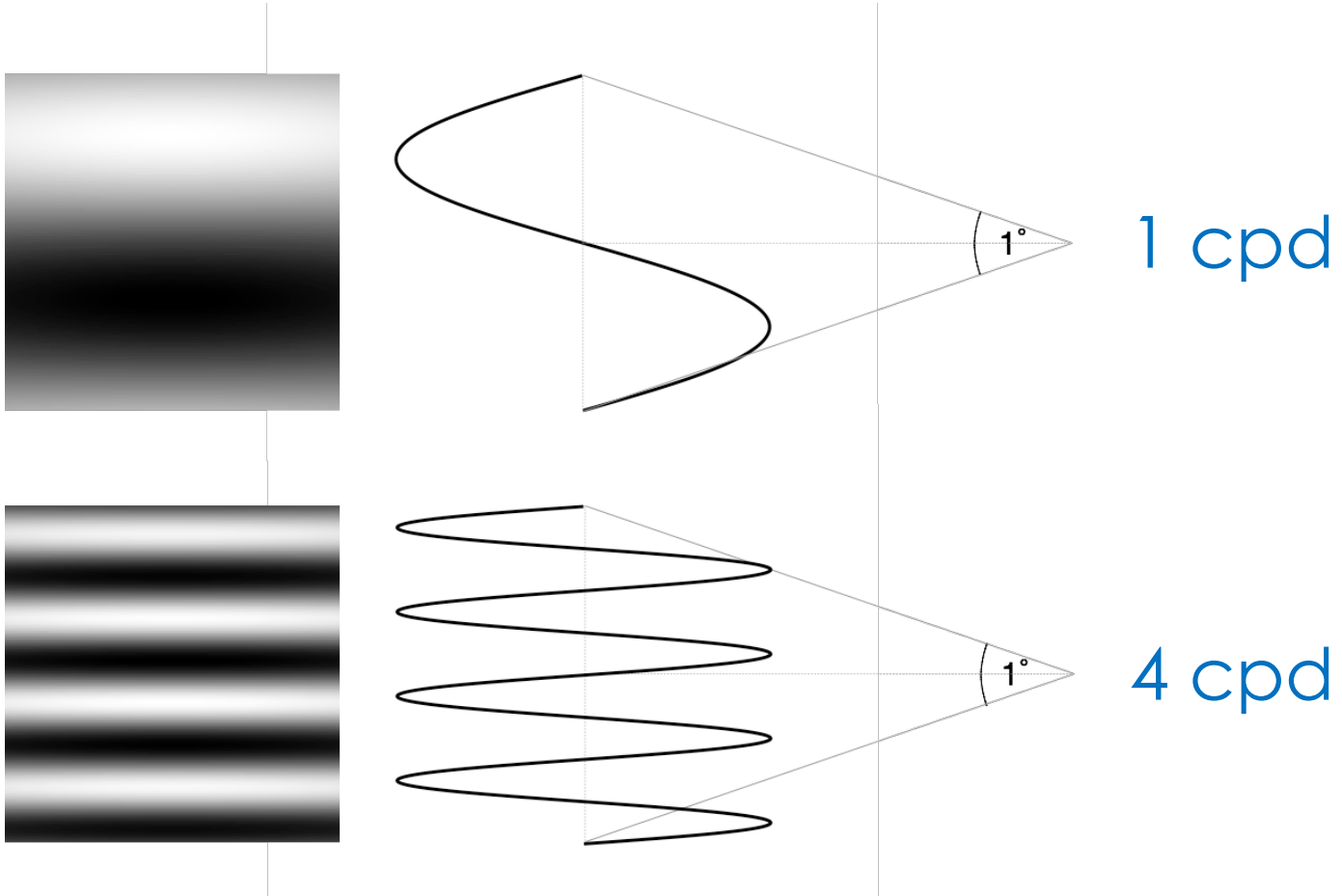
High SF



Viewing angle



Spatial frequency in cycles per degree (cpd)

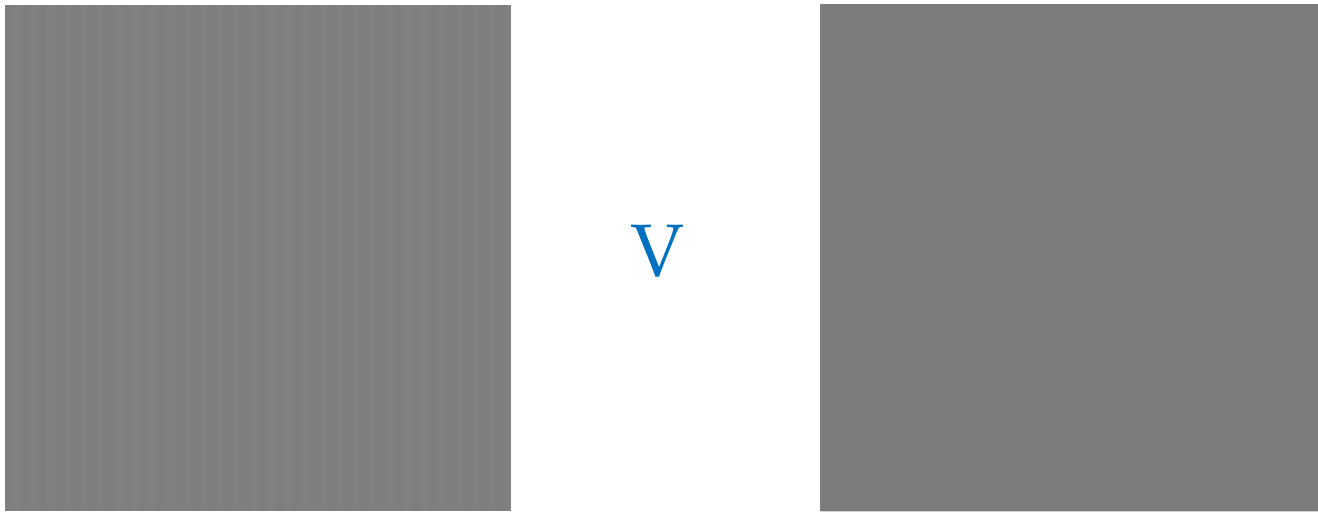


Contrast threshold



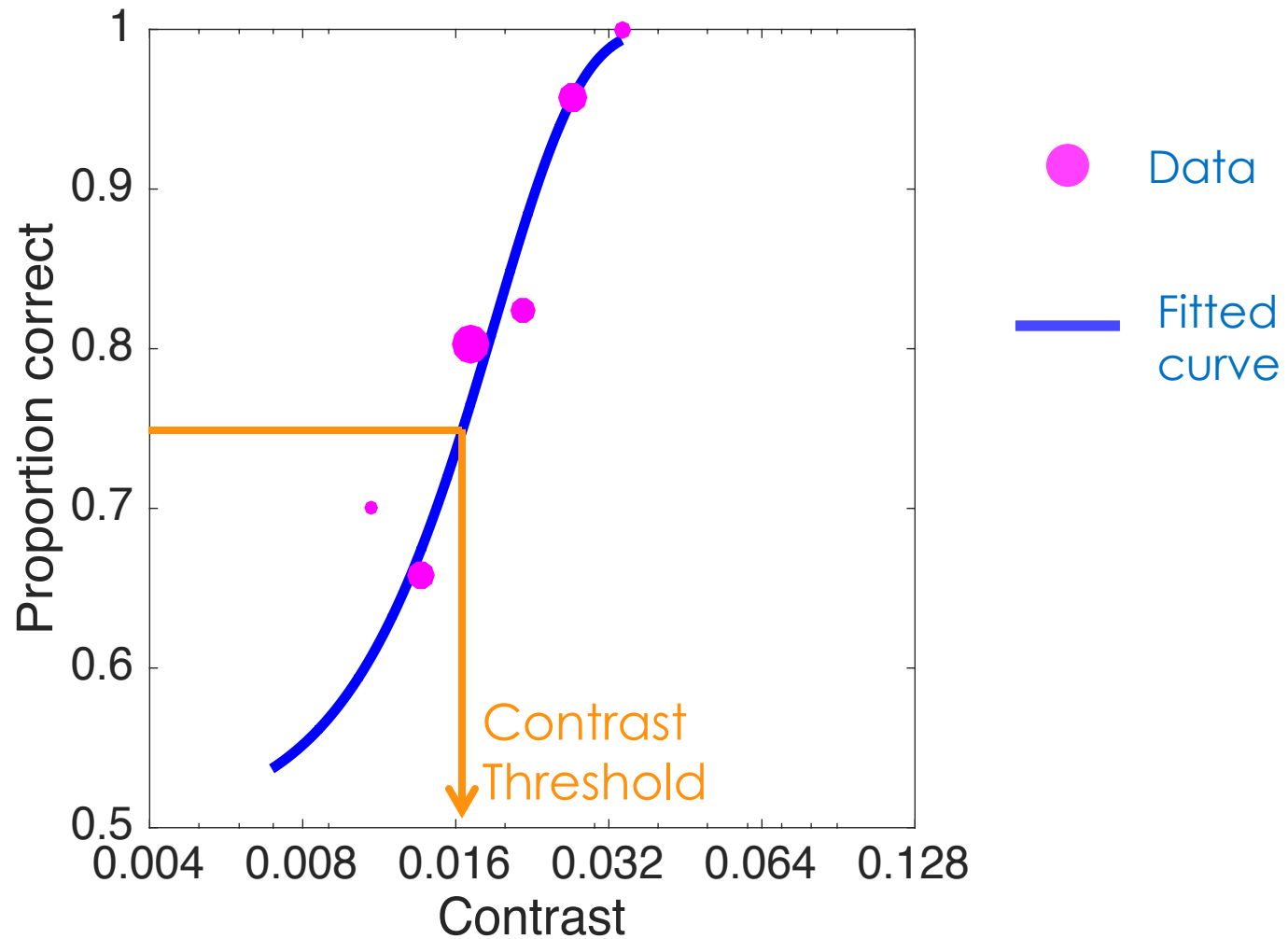
← Around here!

Two-alternative forced-choice task “2AFC”



Which one has the stimulus?

Psychometric Function



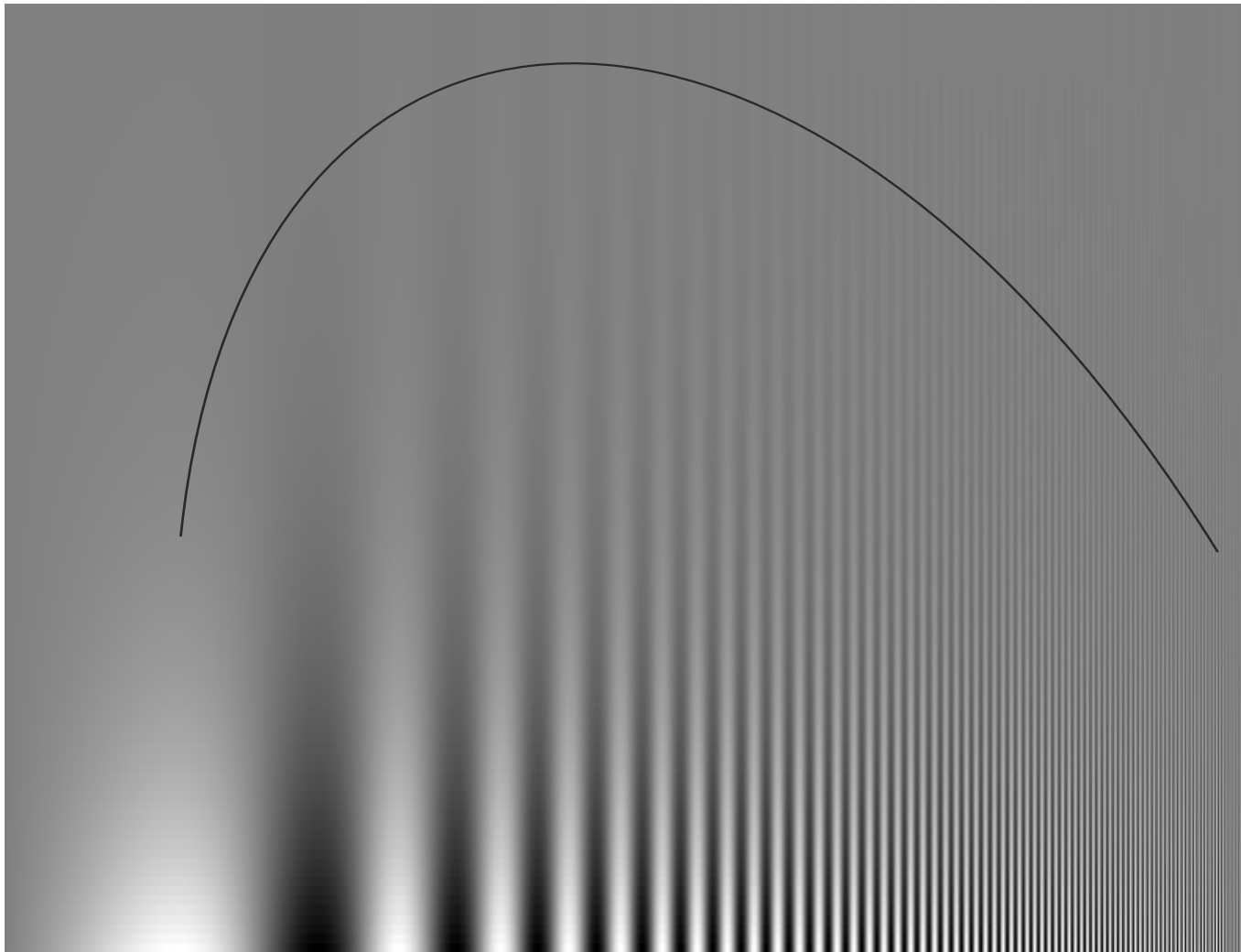
Contrast sensitivity

=

1/contrast threshold

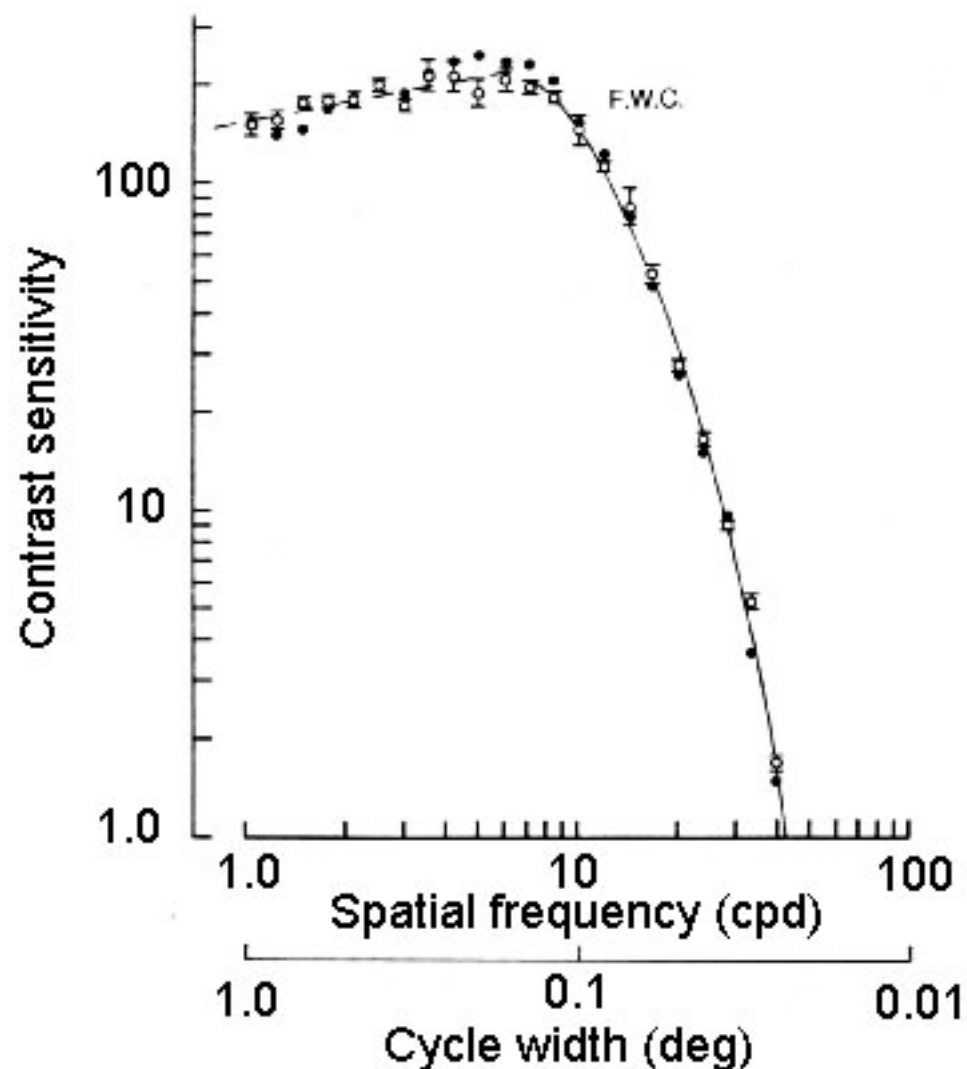
Contrast sensitivity function (CSF)

Contrast



Spatial Frequency

Human Contrast Sensitivity Function (CSF)



Snellen Eye chart

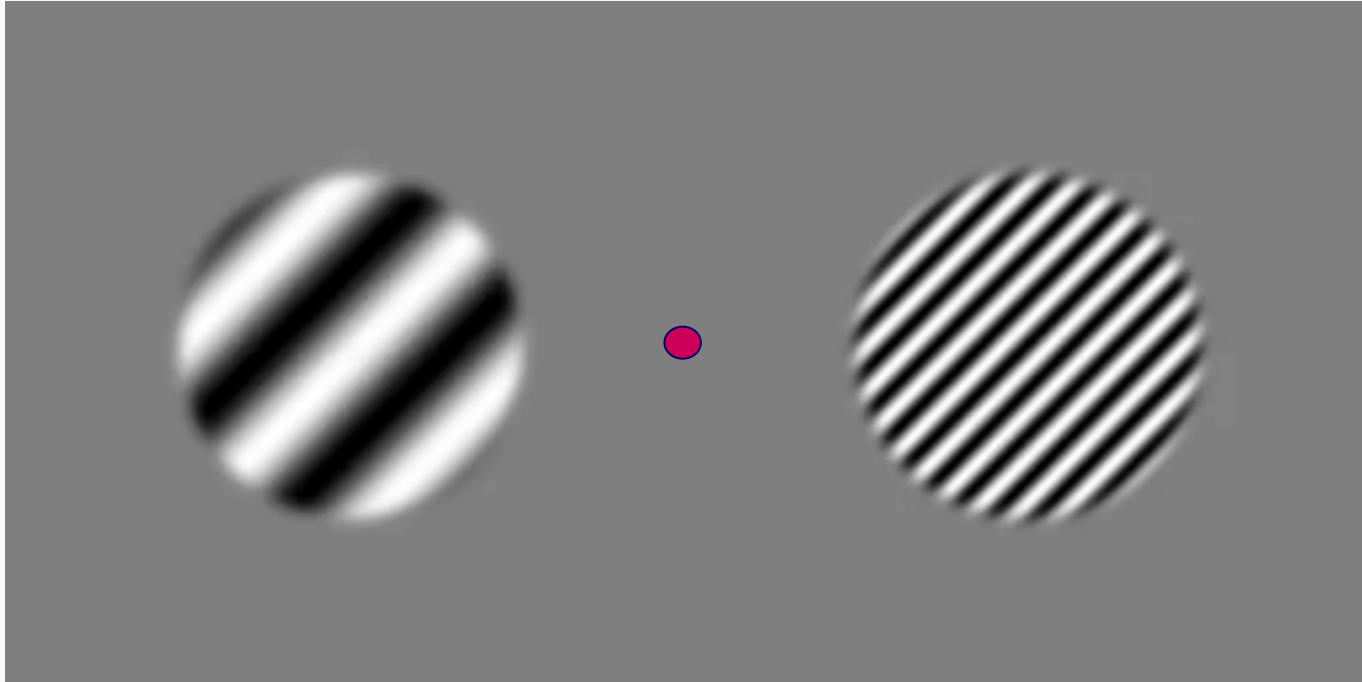
E	1	20/200
F P	2	20/100
T O Z	3	20/70
L P E D	4	20/50
P E C F D	5	20/40
E D F C Z P	6	20/30
F E L O P Z D	7	20/25
D E F P O T E C	8	20/20
L E F O D P C T	9	
F D P L T C E O	10	
P E Z O L C F T D	11	

Units and definitions for the Seeing Patterns lectures

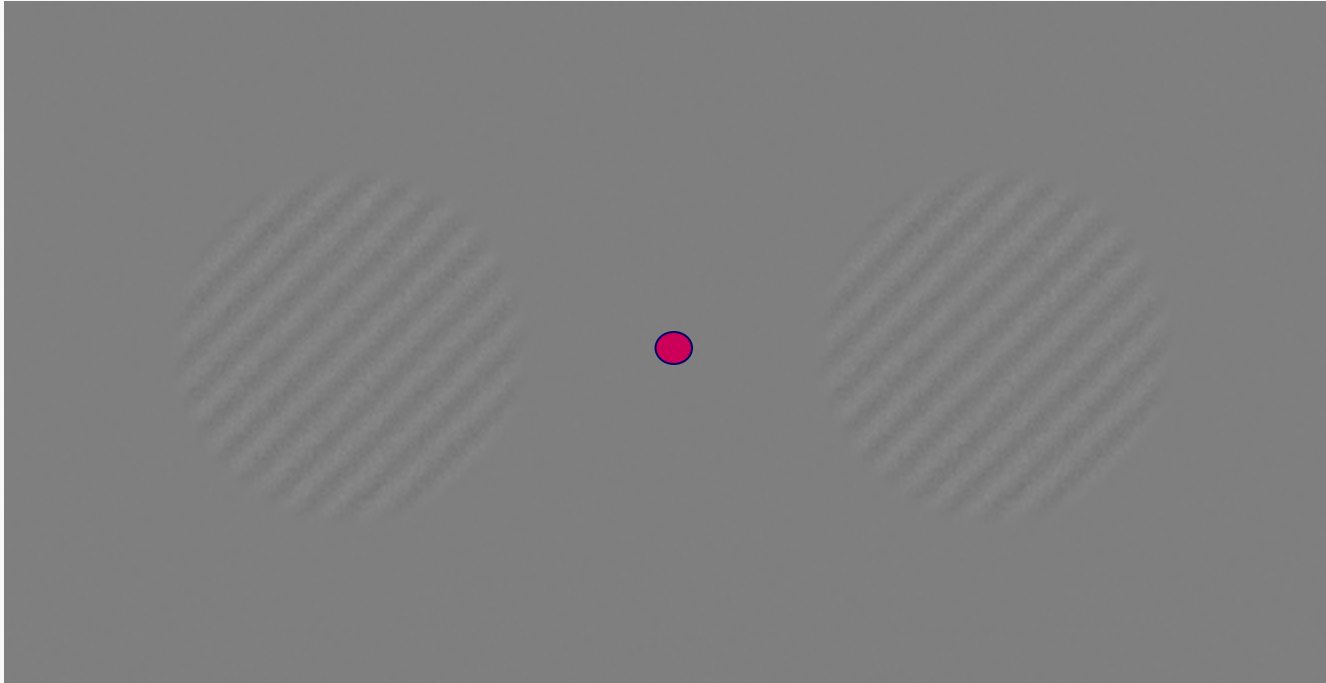
Term	Units/definition
Visual angle	degrees (deg), minutes (arcmin), seconds (arcsec)
Luminance	L, candelas per square metre (cd/m ²)
Mean Luminance	L _{mean} (cd/m ²)
Sine-wave grating	$L(x) = L_{\text{mean}} + A \sin(2\pi f x + p)$ (A=amplitude, f=spatial frequency, p=phase)
Michelson Contrast C	$(L_{\text{max}} - L_{\text{min}}) / (L_{\text{max}} + L_{\text{min}})$ or A / L_{mean}
Cycle width, or period	Degrees of visual angle (deg)
Spatial Frequency (1/cycle width)	Cycles per degree (c/deg or cpd)
Contrast threshold	Minimum detectable contrast C
Contrast sensitivity	1/Contrast threshold i.e. 1/C
Acuity or resolution limit	Highest spatial frequency at which a grating can be detected when at full contrast (c/deg)
Reflectance	% of light reflected
Brightness	Perceived luminance
Lightness	Perceived reflectance

Channels for spatial frequency

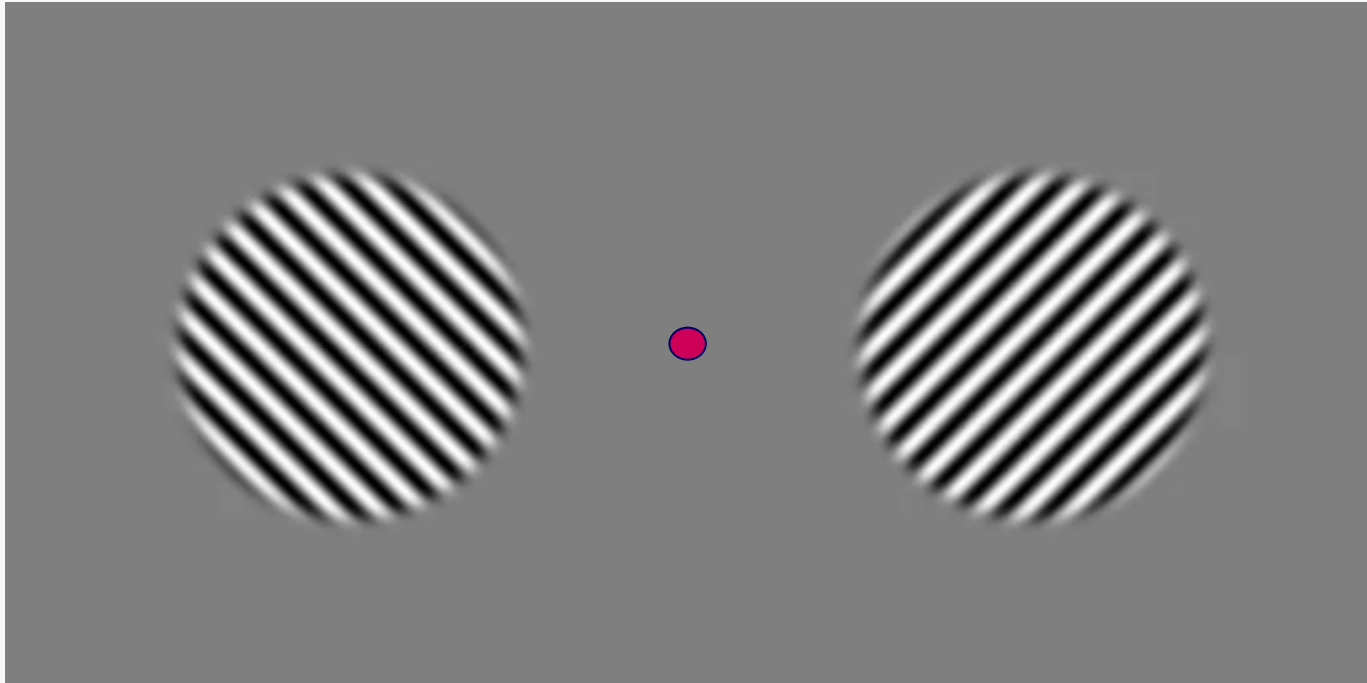
Stare at the red dot....



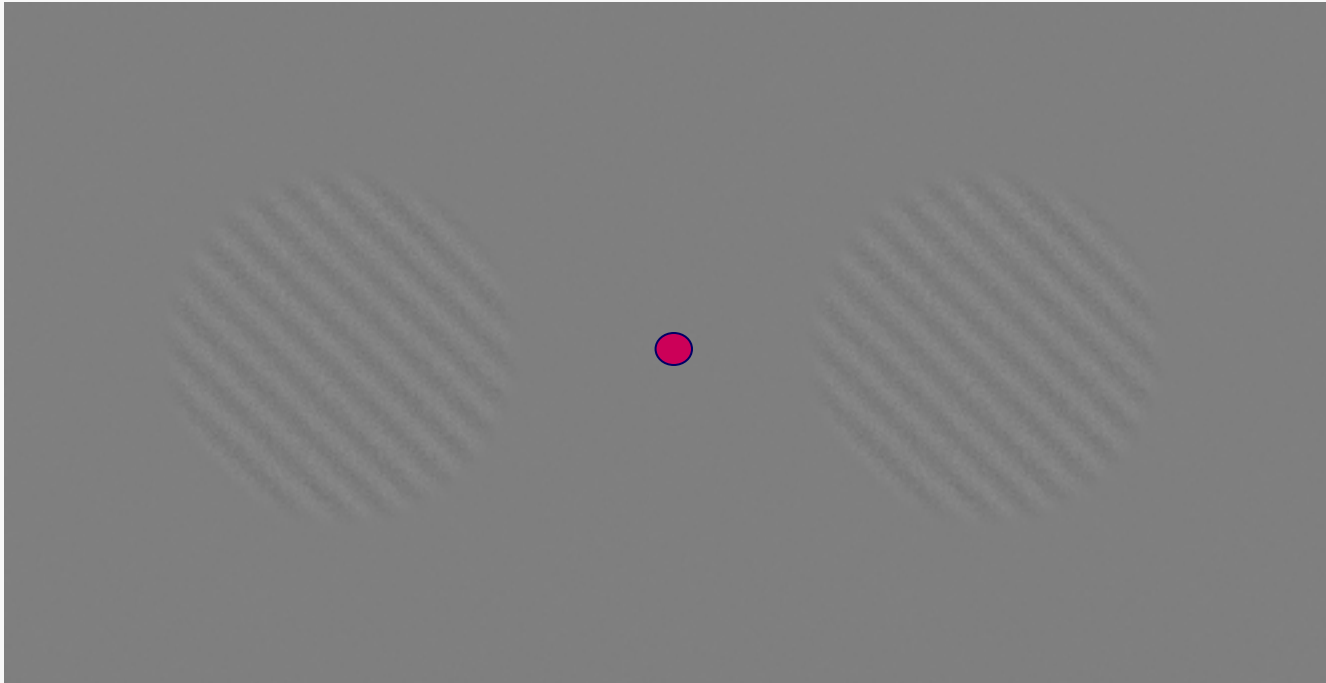
Which one has temporarily has disappeared?



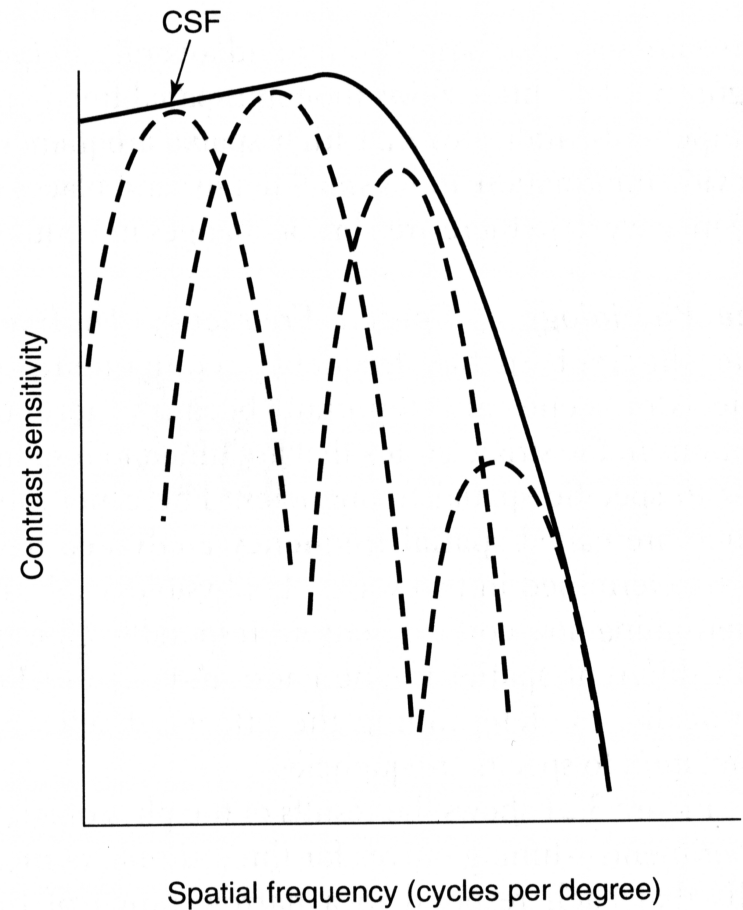
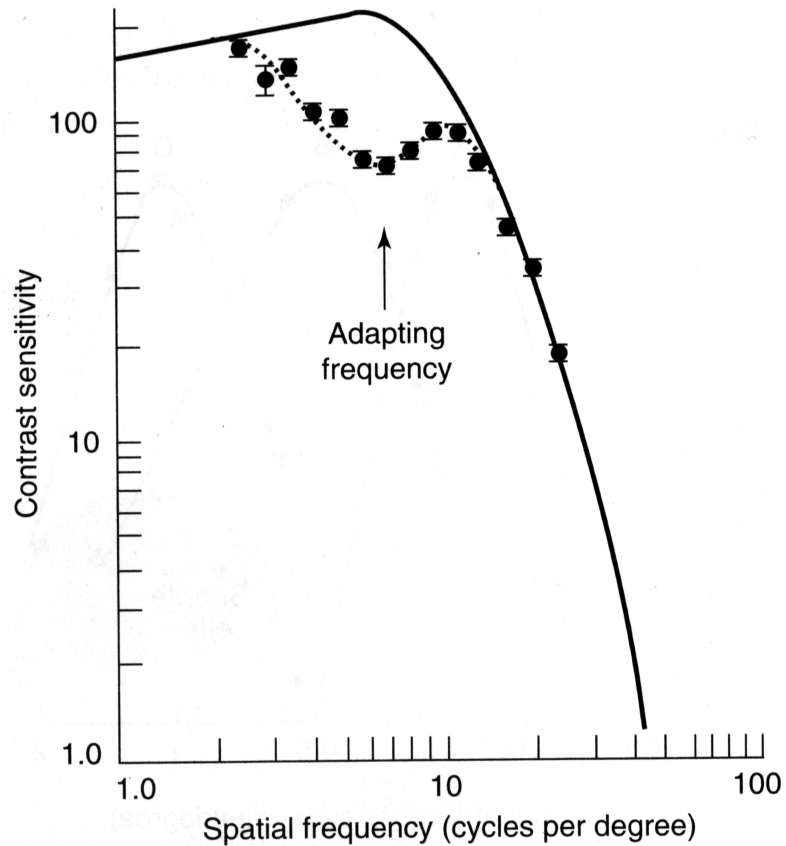
Stare at the red dot....



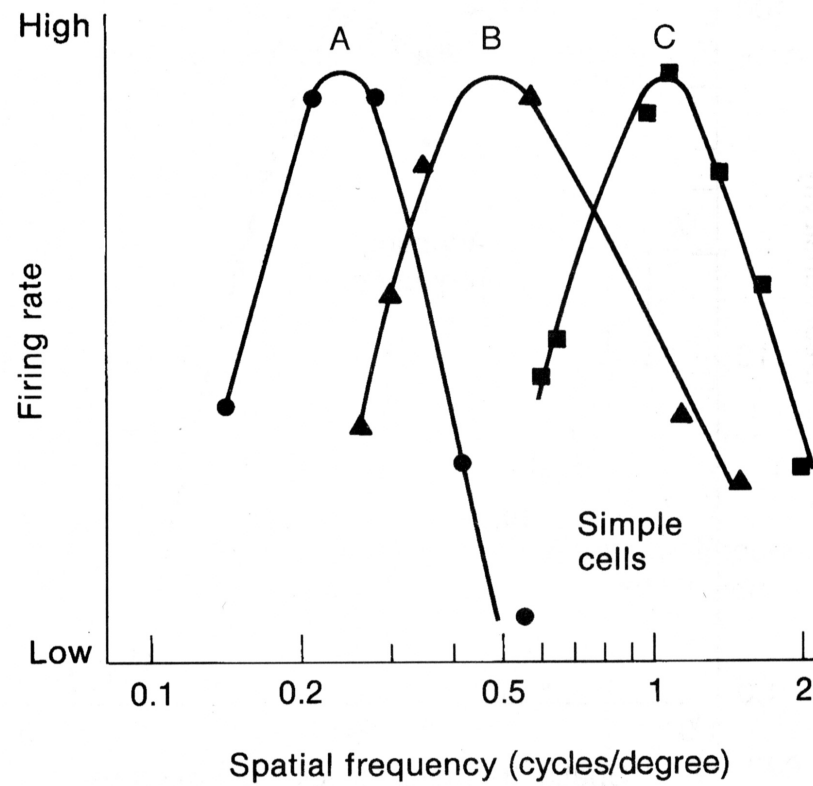
Which one has temporarily disappeared?



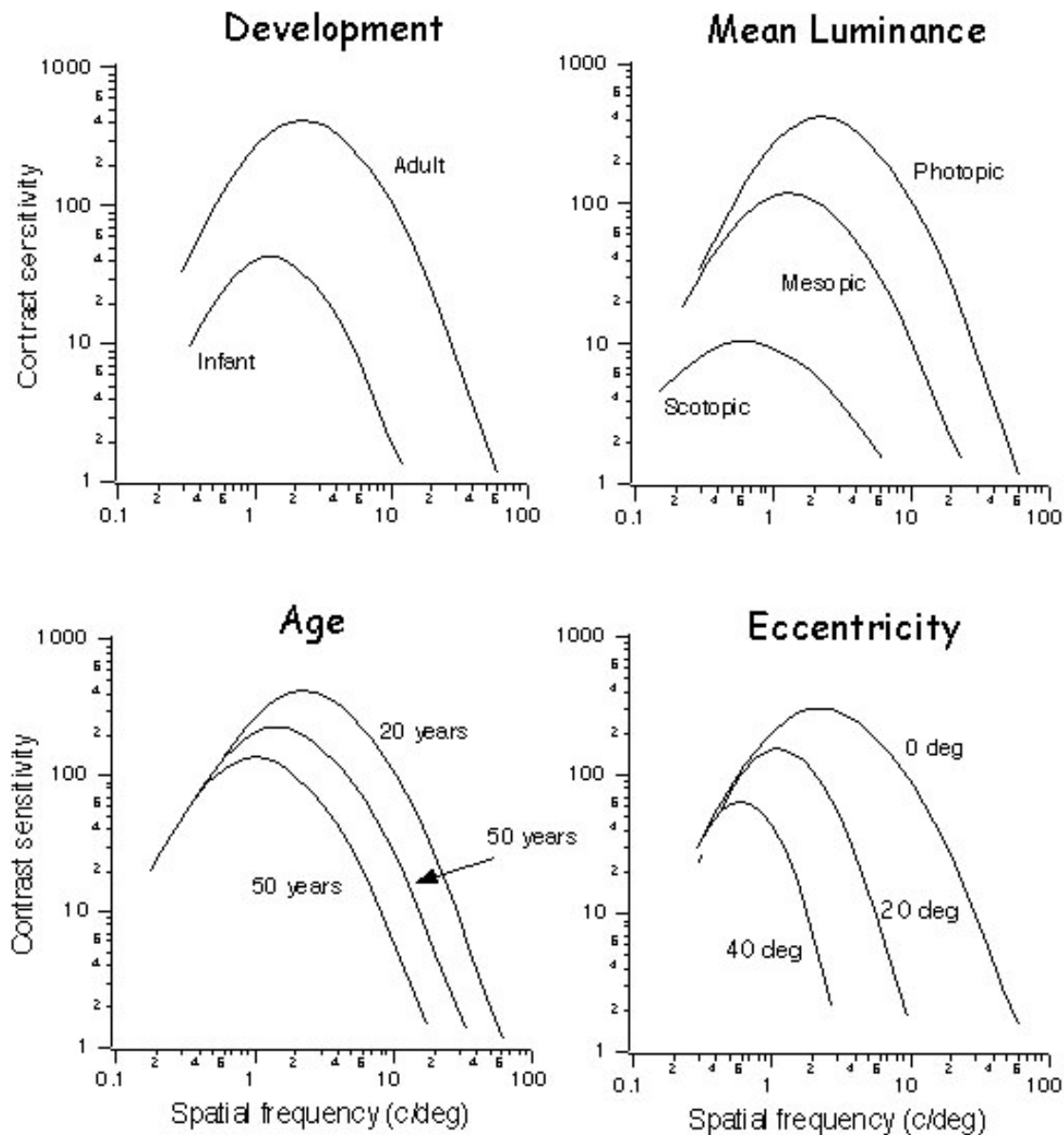
Effect of adaptation on contrast sensitivity



Physiological recordings of contrast sensitivity in simple cells



Changes in contrast sensitivity



But is this what babies SEE....?



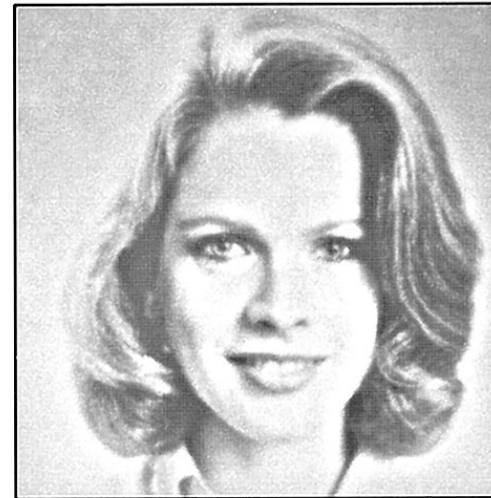
1 month



2 months



3 months



Adult