

PSY 4036

Week 2: Anatomy of the Eye and Visual Acuity

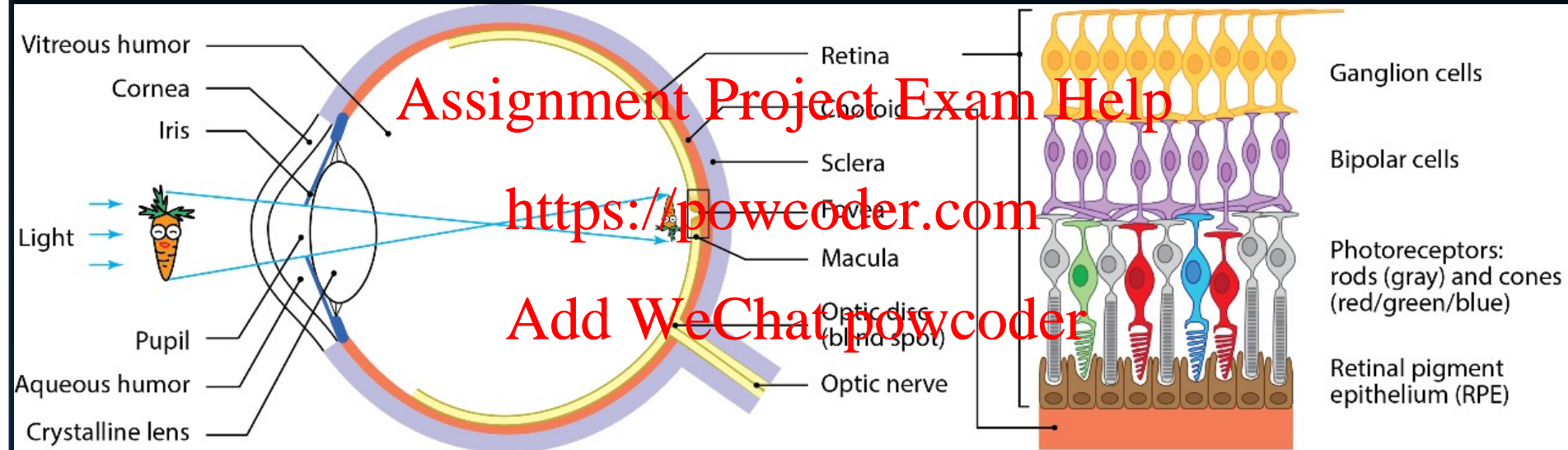
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- Brief survey of the anatomy of the eye
- Visual size and visual angles
- Visual acuity – its measurement and the impact of acuity reduction.

Structures of the Eye



Visual Angle

Angular Size in radians \approx Physical Size / Viewing Distance

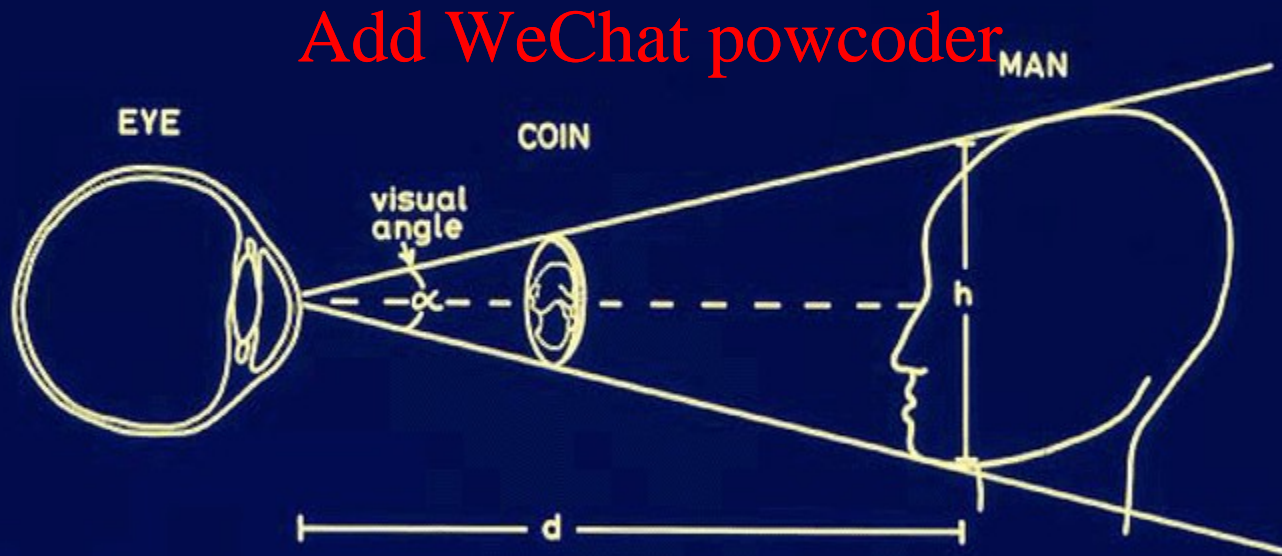
Angular Size in degrees $\approx 57.3 \times$ Angular Size in radians

$= 57.3 \times$ Physical Size / Viewing Distance

where the physical size and viewing distance must be measured in the same units (typically, mm, cm, or inches). These approximations hold when the physical size is significantly smaller than the viewing distance.

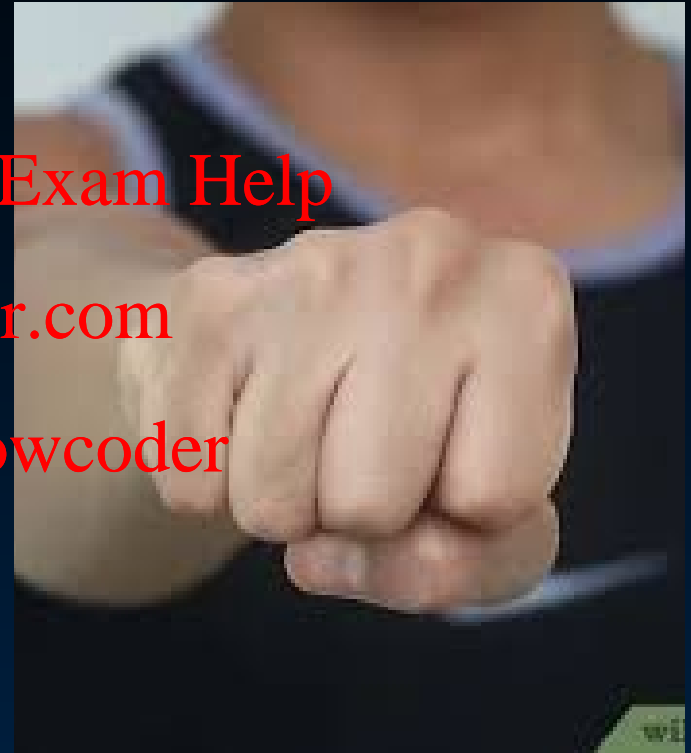
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AN EXAMPLE OF VISUAL ANGLE



How large does your fist look at arm's length?

- Measure the size of your clenched fist, H .
- With your arm extended, measure the eye-to-fist distance, d .
- Use the formula to compute the visual angle A of your fist in radians.
- Convert to degrees.



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Three Dimensions of Vision Measurement and Loss

- Low vision is usually discussed in terms of:

- Reduced acuity
- Reduced contrast sensitivity
- Visual-field loss.

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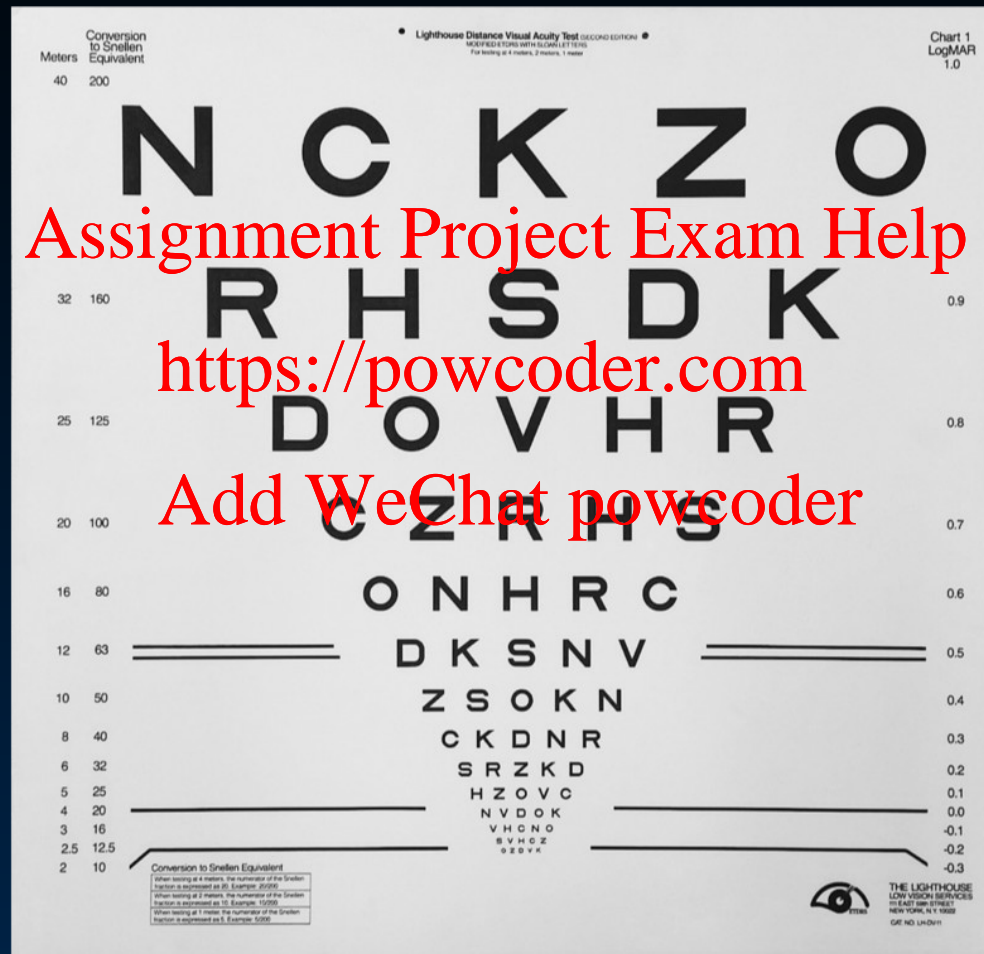
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What is Visual Acuity?

- Visual acuity: determines the smallest visual size (visual angles) of objects that can be recognize.
- An object's visual size is determined by its size/distance ratio.
- At a fixed distance, acuity determines the smallest objects that can be recognized, such as letters on an eye chart.
- For objects of a given size, acuity determines the greatest distance at which the objects can be recognized, such as the maximum distance for reading road signs.

Lighthouse Letter Acuity Chart



Acuity Ranges

- Traditional standard for Normal vision – 20/20
- “Normal” Vision – 20/8 – 20/40
- Mild Low Vision – 20/40 – 20/80
- Moderate Low Vision – 20/80 – 20/200
- Legal Blindness (U.S.) – 20/200
- Severe Low Vision – 20/200 – 20/1600
- “Blindness” (WHO) - < 20/400
- Ultra Low Vision - < 20/1600
- Light Perception (LP)
- Total Blindness

Simulating 5 Levels of Acuity



Original



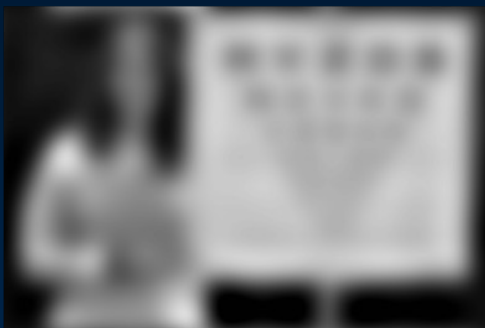
20/40



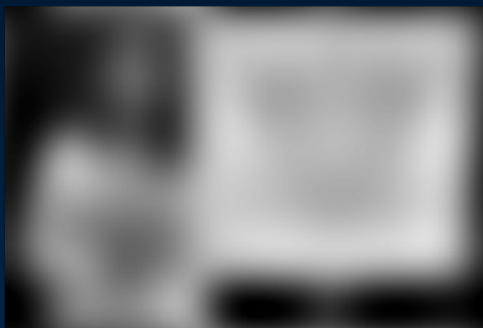
20/80



20/160



20/320



20/640

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MNREAD Reading Acuity Chart

MNREAD Acuity Chart			CARD 1			MNREAD Acuity Chart			CARD 1		
M size			Snellen at 40cm	logMAR at 40cm		M size			Snellen at 40cm	logMAR at 40cm	
8.0	My father takes me to school every day in his big green car			20/400	1.3	4.0	My father asked me to help the two men carry the box inside			20/200	1.0
						3.2	Three of my friends had never been to a circus before today			20/160	0.9
						2.5	My grandfather has a large garden with fruit and vegetables			20/130	0.8
6.3	Everyone wanted to go outside when the rain finally stopped			20/320	1.2	2.0	He told a long story about ducks before his son went to bed			20/100	0.7
						1.6	My mother loves to hear the young girls sing in the morning			20/80	0.6
						1.3	The young boy held his hand high to ask questions in school			20/63	0.5
						1.0	My brother wanted a glass of milk with his cake after lunch			20/50	0.4
5.0	They were not able to finish playing the game before dinner			20/250	1.1	0.8	I do not understand why we must leave so early for the play			20/40	0.3
						0.6	It is more than four hours before we leave for the city			20/32	0.2
						0.5	The boys were in such the school before we got home			20/25	0.1
						0.4	The students were in the school before we got home			20/20	0.0
						0.32	The students were in the school before we got home			20/16	-0.1
						0.25	The students were in the school before we got home			20/13	-0.2
						0.20	The students were in the school before we got home			20/10	-0.3
						0.18	The students were in the school before we got home			20/8	-0.4

Sample MNREAD data

