SO2D01

Eyes on Vision

MOOC Module 2

Dr. Lydia Yu

Office: HJ515 **Tel/Whatsapp: 2766 6110**

Email: lydia.yu@polyu.edu.hk

Intended Learning Outcomes (MOOC Module 2)

Upon completion of the subject, students will be able to:

a. acquire a general knowledge of the **human eye structures and functions**

b. estimate the **resolution capability of the human eye** and describe **how vision can be measured**

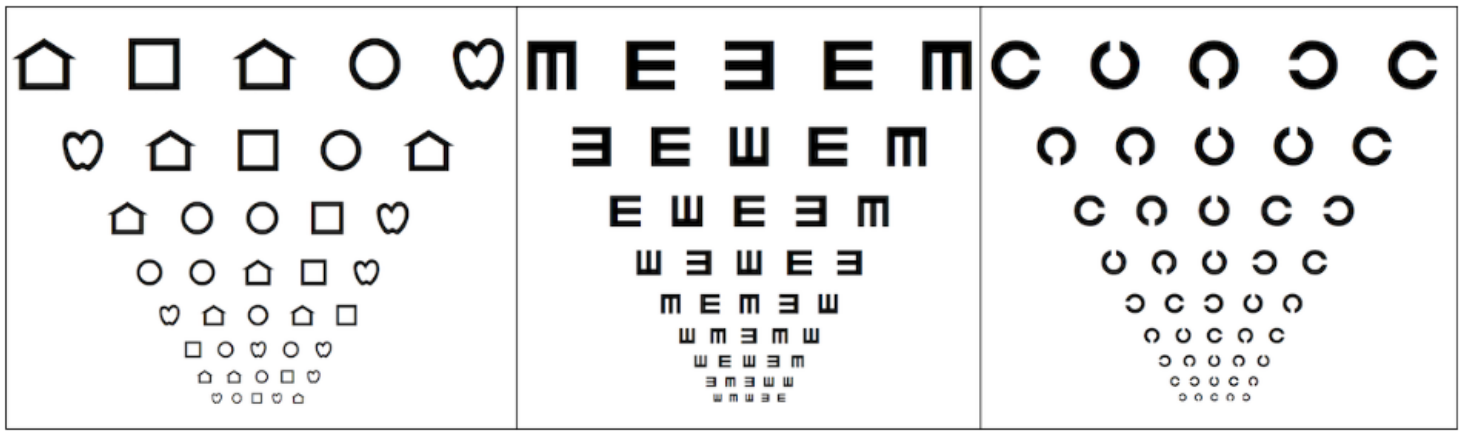
c. recognize how deficiency in **depth perception and color vision** will affect our daily lives

d. identify **common eye conditions** and **eye diseases including refractive errors and ways of corrections**

e. apply approaches to **protect the eyes from injury, improve general eye hygiene and take good care of the eyes**

f. use different strategies to **plan, design, create, and present information** learned on a topic of interest (i.e. on eyes or vision)

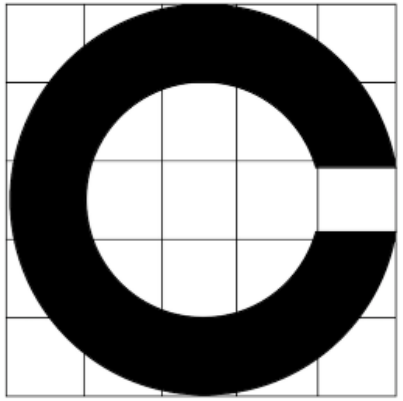
g. evaluate information from a variety of sources and **debunk myths about the eyes and vision**

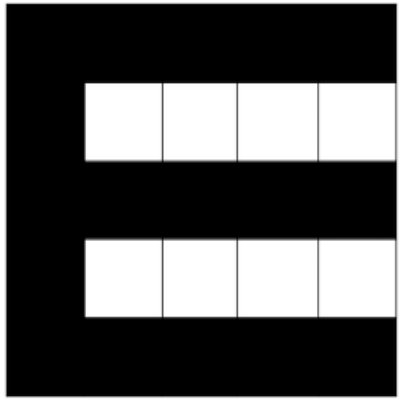


E	1	20/200
F P	2	20/100
T O Z	3	20/70
L P E D	4	20/50
P E C F D	5	20/40
E D F C Z P	6	20/30
F E L O P Z D	7	20/25
D E F P O T E C	8	20/20
L E F O D P C T	9	
F D P L T C E O	10	
P E Z O L C F T D	11	

How does the eye chart work?

- The letters on the eye chart are constructed on the 5x5 grid
- Each stroke and each gap in the letter subtends one-fifth of the entire letter





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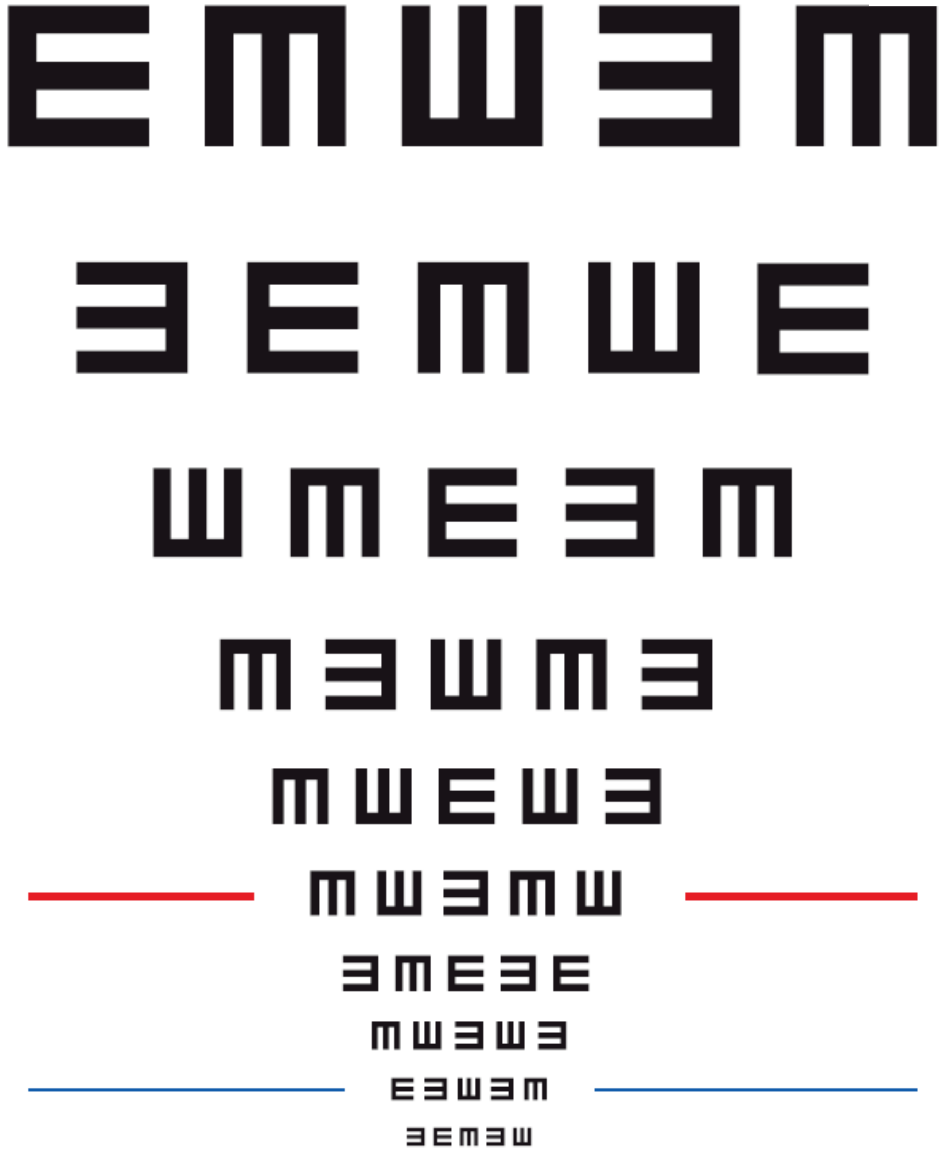
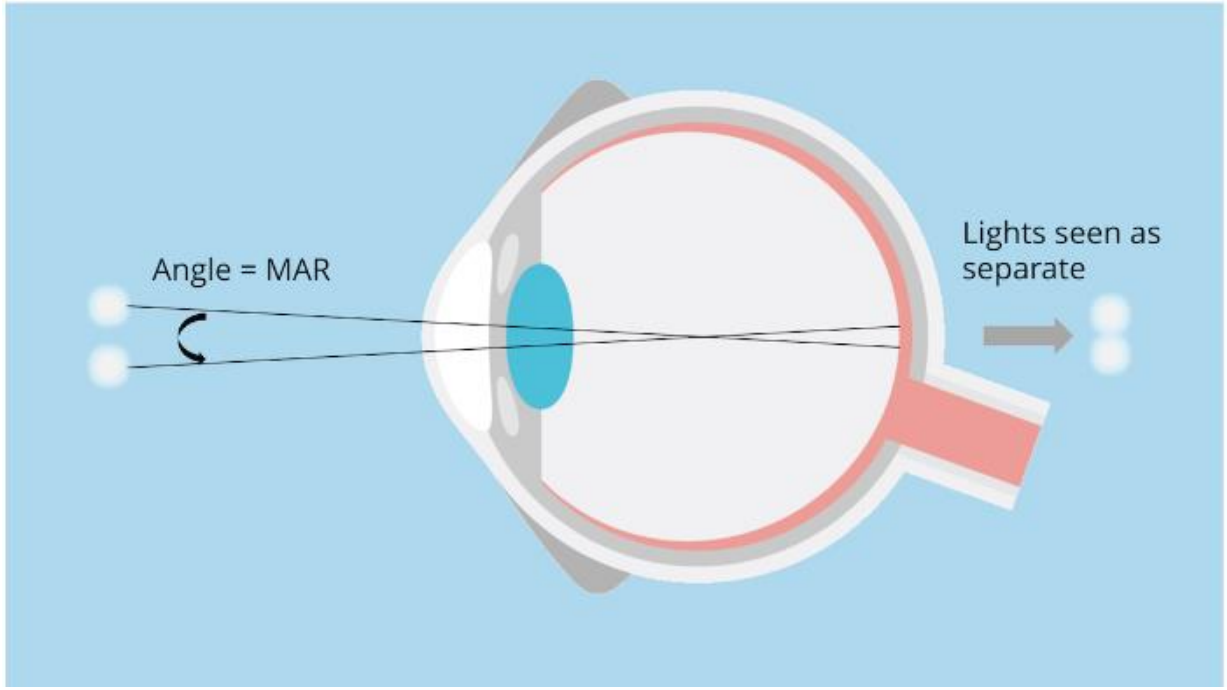
Visual Acuity Chart

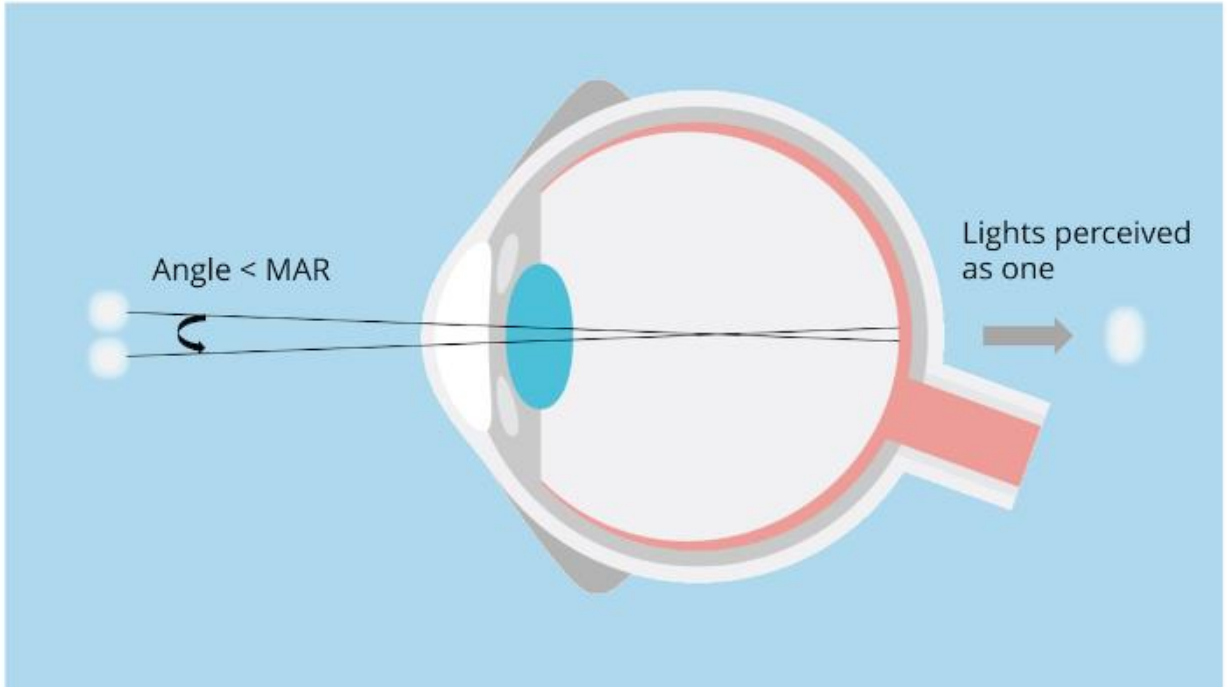
Snellen VA



Resolution capability of the human eye

- The resolution capability of the eye is described in **angles**
- The angle at which you can just discern two separate lights is the ***minimum angle of resolution* (MAR)** of the eye
- In healthy eyes the minimum angle of resolution is about 1/60 of a degree, also known as 1 *arc minute*





What do the numbers of a visual acuity (VA) mean?

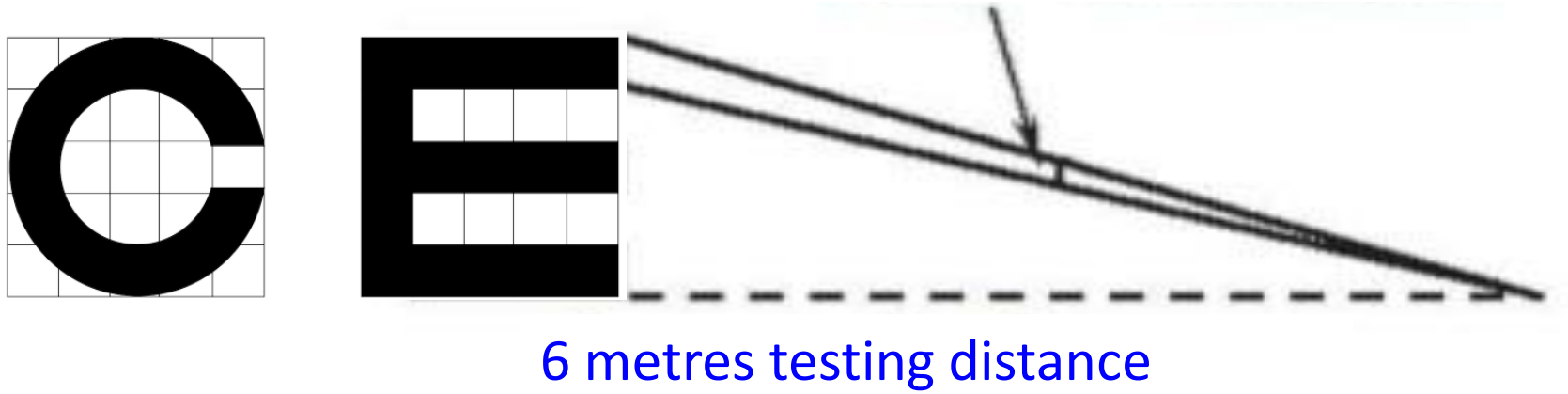
US	UK
$\frac{20}{20}$ or	$\frac{6}{6}$

Testing distance of eye chart in feet or metre

Distance at which the optotype subtends an angle of 5 minutes of arc

- The VA chart is designed so that the letters on the 6/6 line subtend 5 minutes of arc at 6 metres

Visual Acuity = angular size of the smallest target that can just be resolved



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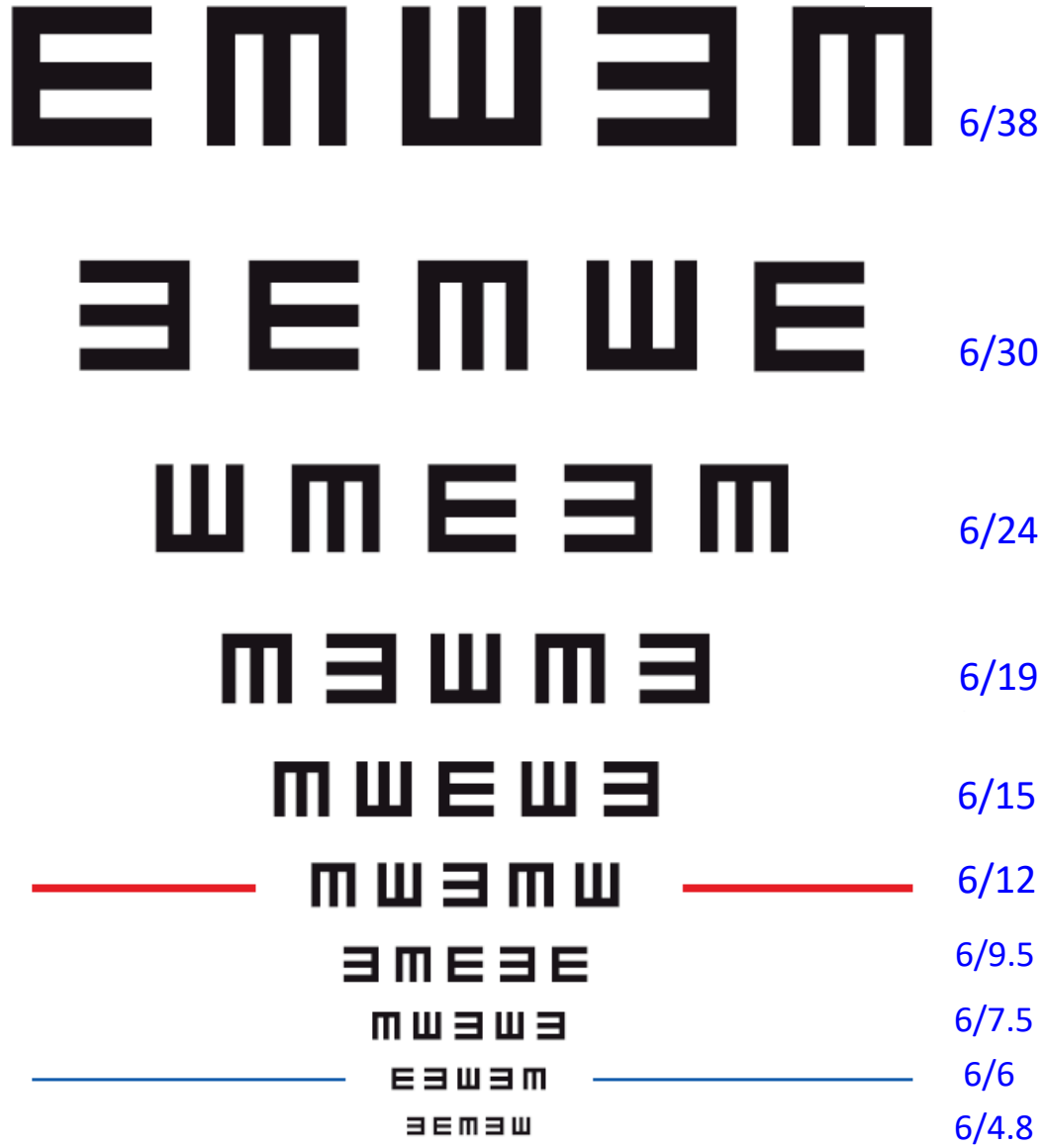
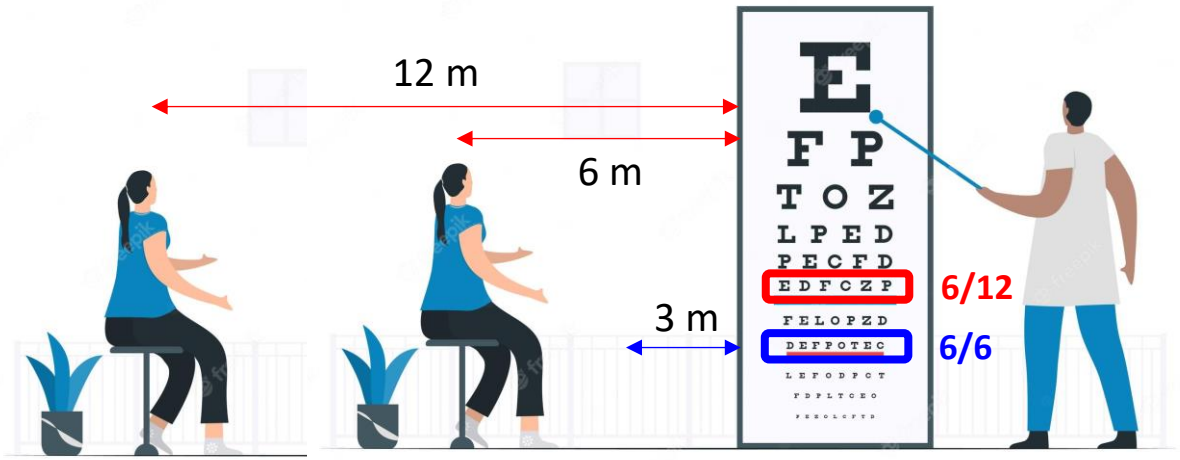
Visual Acuity Chart

Snellen VA



What does it mean by a VA of 6/12?

- A person with normal vision (6/6) can see this line at 12 metres
- If a person can only read as small as the 6/12 line on the chart at 6 metres, this means that the person needs to be at half the distance to see what a person with normal vision can see
- **The larger the denominator, the worse the visual acuity is**



Modified from https://www.freepik.com/premium-vector/visual-acuity-is-testing-check-measure-clarity-vision_11941435.htm

MOOC Module 2.2.5

Knowledge check

3 points possible (ungraded)

1. How close would a person with visual acuity of 6/18 have to stand to the eye chart to read the 6/6 line?

- ◯ one metre
- ◯ two metres
- ◯ three metres

MOOC Module 2.4.1 – Virtual Lab

What is your visual acuity?

Measure and record your visual acuity.

Equipment

You will need a printer, paper, tape, a tape measure, and another person to help you.

Procedure

1. Download and print **the Hong Kong PolyU visual acuity chart** PDF. **Be sure to choose 'actual size' when printing. To ensure the chart has printed correctly, check that the reference 'E' at the top is 1 cm.**
2. Tape the chart to a wall and stand 3 metres in front of the chart. (The letter size has been calibrated for this distance.) Ask the other person to stand next to the chart.
3. Cover one eye. Starting at the top of the chart, try to correctly identify the orientation of the 'E's in each row. Ask the other person to confirm whether your answers are correct.
4. Continue down the chart until you can no longer see the 'E's clearly. Then cover your other eye and try again. Finally, try with both eyes viewing the chart together.
5. Record the visual acuity for each eye individually and then with both eyes viewing the chart together. Remember, your visual acuity is the smallest line you can resolve.

Instructions for in-class activity A

1. Put on your glasses (if any). Cover one eye. Starting at the top of the chart, try to correctly identify the orientation of the 'E's in each row.
2. Continue down the chart until you can no longer see the 'E's clearly. Then cover your other eye and try again. Finally, try with both eyes viewing the chart together.
3. **Record your own visual acuity** for the **right eye, left eye, and both eyes** together. If you are unable to see the top line, you can record 'worse than 6/38’.
4. Test someone else!

https://pigeonhole.at/R3TDNA

Instructions for in-class activity B

The pinhole effect

1. Remove your glasses and check your vision again. Record your visual acuity for each eye individually.
2. Now repeat and record the measurement for each eye while looking through the pinhole.
3. Did your visual acuity improve?

If vision improves when looking through the pinhole, the problem is due to refractive error. If vision does not improve, further investigation is needed to determine if there is underlying eye disease.

Eye disease simulating goggles

1. Now try out the different simulating goggles and check your VA again. Does your VA improve with a pinhole?

- Cataract
- Glaucoma
- Macular degeneration
- Diabetic retinopathy

MOOC Module 2.6.1 – Assignment

Solve a problem

Before you finish the module, take a few minutes to use your knowledge of the resolution of the eye to solve a practical problem.

Earlier in this module, you learned how to measure and record visual acuity. You also learned about the relationship between viewing distance, dot pitch in display screens, and the minimum angle of resolution (MAR).

Imagine someone in your family or a close friend has asked you for advice about buying a new TV or computer monitor. They are trying to choose between a more expensive 4K UHD model and a cheaper 1080p HD model. They have the money to buy a 4K model, but do not want to buy one unless they are sure the screen resolution will be noticeably different from 1080p. They do not want the screen size to be larger than necessary for their viewing distance.

Based on their visual acuity and viewing distance, which screen size and which display option would you recommend?

Rubrics

What will this assignment be graded on?

Does the answer make a clear and correct recommendation for screen size and display type?

Poor	No recommendation for screen size or display type, or not enough information is provided to determine whether the recommendation is correct.	0 POINTS
Good	The recommendation is not clear or part of the recommendation is missing, or the recommendation is not correct, based on the information provided.	3 POINTS
Excellent	The recommendation for screen size and display type is correct, based on the information provided.	5 POINTS

Does the answer show the learner's calculations and explain how they arrived at their recommendation?

Poor	No evidence of the learner's calculations or how they arrived at their recommendation.	0 POINTS
Good	Some evidence of the learner's calculations and how they arrived at their recommendation, but lacks detail or some parts are incomplete.	3 POINTS
Excellent	Clear evidence of the learner's calculations and clear explanation of how they arrived at their recommendation.	5 POINTS

Response Example

My friend is actually looking to buy a new computer monitor so I'm going to share my advice with her: get a 4K monitor with a 21.5" screen. Her visual acuity is 20/20 (I tested her this morning), and she typically sits 50cm from the monitor when working.

For my friend to be able to resolve the pixels at that distance, the dot pitch would need to be greater than or equal to 0.1454mm:

Resolution distance = dot pitch / tan(1/60)
500mm = dot pitch / tan(1/60)
dot pitch ≥ 500mm x tan(1/60)
dot pitch ≥ 0.1454mm

The 21.5" 4k monitor has a dot pitch of 0.1162, so she would not be able to resolve the pixels at a distance of 500mm. By contrast, the 21.5" 1080p monitor has a dot pitch of 0.2479mm, so the pixels would be noticeable at a distance of up to 851.9mm. The 4k version would be noticeably better at her typical viewing distance, so it is worth the extra investment.

Refer to Module 2.3.1 for a step-to-step guide of the calculations

IN PROGRESS (3 OF 3)

2 Learn to Assess Responses

Learning to Assess Responses

Before you begin to assess your peers' responses, you'll learn how to complete peer assessments by reviewing responses that instructors have already assessed. If you select the same options for the response that the instructor selected, you'll move to the next step. If you don't select the same options, you'll review the response and try again.

The question for this section

> Think about what you have learned during this module. Choose a structure or function that you didn't know about before taking the module. Write a paragraph saying what you have learned, why it is important to you, and what else you would like to learn in future modules of the course.

The response to the prompt above:

I started this course with only a basic understanding of the human eye, and now I know so much more about it. For me, I think the most 'eye-opening' part of this module was the section on floaters - I had noticed them before but had no clue what they were. Now I know these are just the shadows of particles floating in my vitreous gel. I've always been fascinated by 'Magic Eye' pictures and 3D drawings, so in that part of the course I'm really looking forward to applying some of my knowledge about how visual information is processed.

✔ COMPLETE

2 Learn to Assess Responses

IN PROGRESS (2 OF 2)

▸ 3 Assess Peers

▸ Your Grade: Not Completed

▸ Top Responses

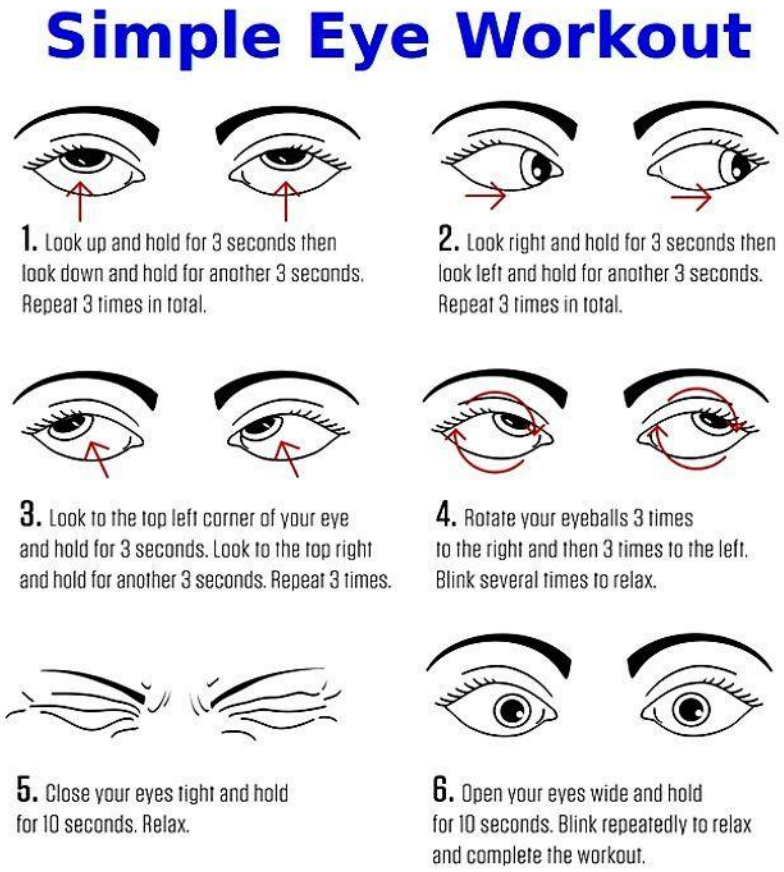
Myths to debunk

1. VA of 6/6 means you have perfect vision

True or False?

Why?

2. Eye exercises will improve your vision



qnaguides.com

True or False?

Why?

3. Wearing glasses will make your refractive error even worse

True or False?

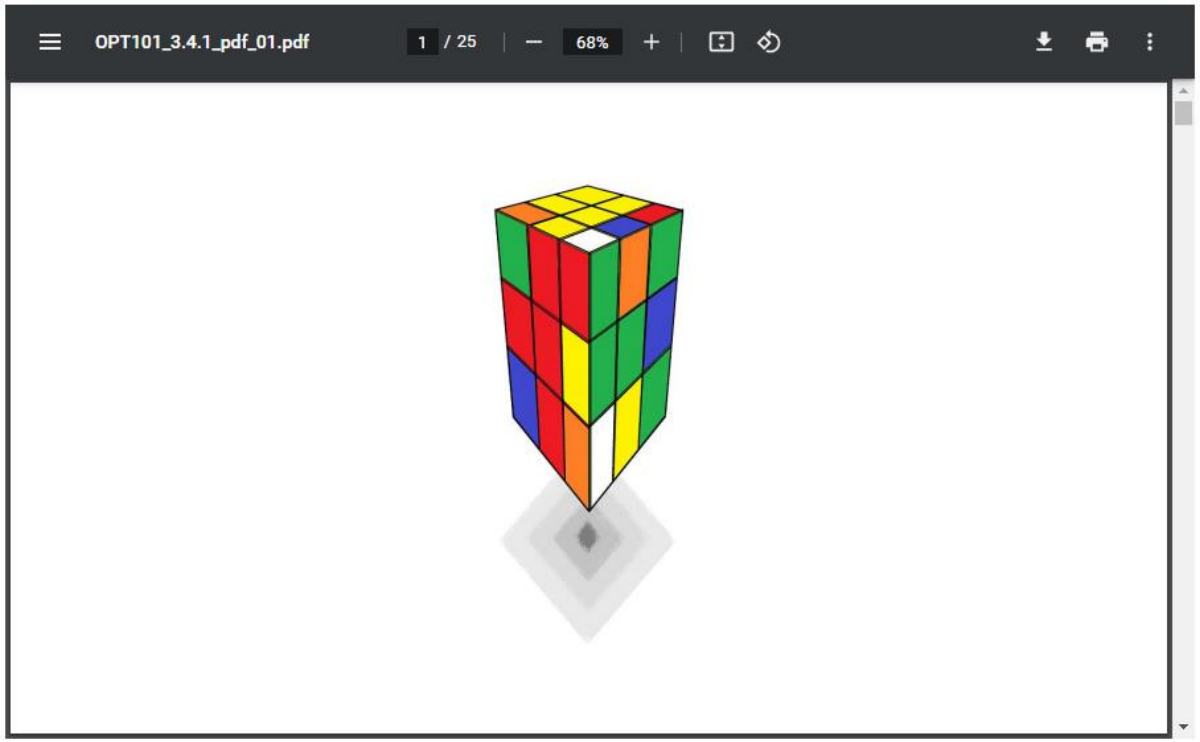
Why?

MOOC Module 3 – Virtual Lab

3D art tutorial

Follow the steps in this tutorial to create your own floating Rubik's Cube. In this tutorial, the artist uses Microsoft Paint, but you can achieve similar results using Preview for macOS. Both programs are free.

Click the down arrow icon in the top right to download the guide in PDF format.

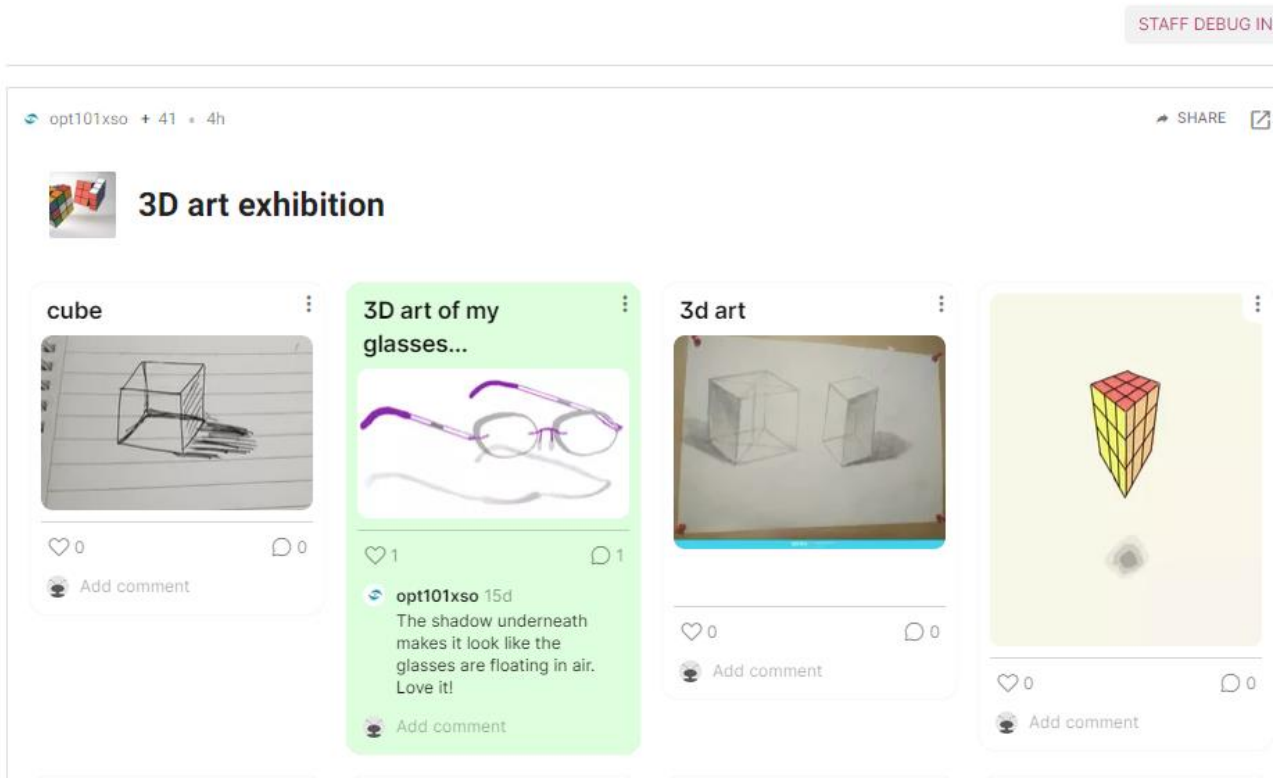


3.4.2 3D art exhibition

Bookmark this page

Virtual lab due Feb 27, 2023 08:00 CST

1. Share your 3D art with other learners by adding it to the Padlet.
2. View at least two other learners' contributions. Use the comment function in Padlet to comment on them. Write two things you like about each one.



MOOC Module 3 – Assignment

3.6.1 Create a 3D photo

Bookmark this page

Assignment due Feb 27, 2023 08:00 CST

Create a 3D photo

Before you finish the module, use your knowledge of depth perception to create a 3D photo.

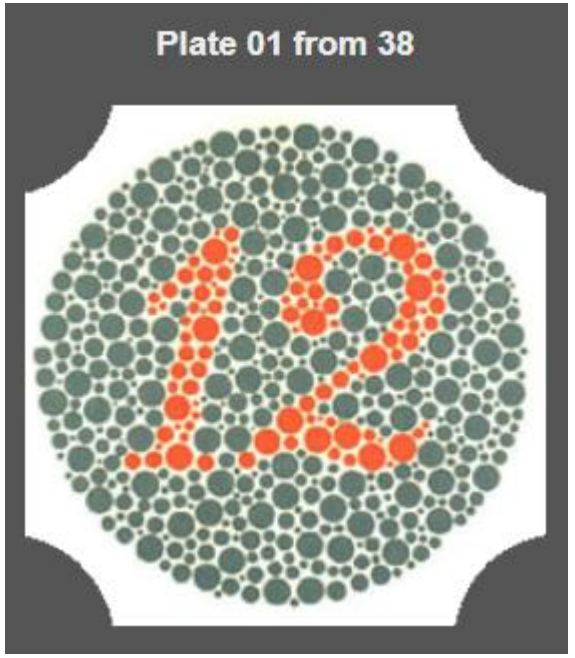
Equipment

You will need a phone or camera.

Procedure

1. Choose a scene to photograph in which part of the scene appears closer to you than the background. In this example, the clock tower and the edge of the building appear closer than the background.
2. Use your phone or camera to take a photo. Make sure the camera is in portrait (vertical) mode.
3. Now move your phone or camera laterally about 5-7cm to the right and take another photo. Be careful not to change the vertical position.
4. Align the pictures side by side, as shown in the example. You can do this in PowerPoint on your computer or using an app like PhotoGrid on your phone. Make sure that the picture taken first is on the left and the picture taken when the camera was moved to the right is on the right.
5. To view the photos in 3D, converge or diverge your eyes as if you are looking at a point in front or behind your screen. You should see three images of the photo. Focus on the image in the middle. In this example, the clock tower and edge of the building will appear to pop out towards you.

MOOC Module 4 – Virtual Lab



4.4.1 Test your colour vision

Bookmark this page

Virtual lab due Feb 27, 2023 08:00 CST

Test your colour vision.

Click on the links below to visit a website where you can test your own colour vision. (Note: This website is not affiliated with PolyU or edX. We advise that you do not click on advertisements.)

Try out the following tests:

1. Ishihara 38 plates CVD test
2. Colour arrangement test

Then take the two polls to share the results of each test.

Disclaimer: This is not a replacement for a professional colour vision test. Results can be affected by the brightness and colour temperature of your screen.

MOOC Module 4 – Assignment

4.6.1 Explore colour vision deficiencies

Bookmark this page

Assignment due Feb 27, 2023 08:00 CST

Explore colour vision deficiencies

Before you finish the module, use a free app to explore colour vision deficiencies further and think about some of the difficulties they might cause you in your daily life.

Download the **CV Simulator app**. Use the app to create a photo that illustrates one of the difficulties you would have if you had a specific colour vision deficiency (or, if you have a colour vision deficiency, a photo that illustrates a difficulty you have). Here is one example to get you thinking:

Questions or concerns?