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# Camera Obscura Instructions

— Team 3: Teddy, Declan, and Alex —

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# Assembly

# Tools List

- 1 ruler
- A triangle
- Pencil
- Exacto Knife or Box Cutter
- Scissors
- Hot Glue Gun
- Hot glue sticks
- Roll of duct tape
- A square yard (approx) of flexible cloth/plastic, preferably opaque

# Materials List

- 22 x 15 x 16 Cardboard box (1x)
- Extra cardboard
- 8.5 x 11 Sheet of paper (1x)

Note:

- (**1x**) stands for **one** of said object
- (**2x**) stands for **two** of said object

# Tips For Cutting

When cutting a straight line, place a ruler next to the line you are cutting to insure a straight cut.

Rather than cutting through the cardboard the first time, scoar the cut, meaning when you cut, go over the cut line several times with the blade without going through. As you cut deeper and deeper with each pass, eventually, one last cut will complete the cut between the two pieces of cardboard.

The slower and more precise each scoar cut, the better and more precise the final cut will be.

# Step 1: Cardboard Cutouts

Cut all required cardboard panels

All Units are in **Inches**

## **Aperture:**

- Piece 1: 6x9
- Piece 2: 1.5x6
- Piece 3 (x2): 1.5x7.5
- Piece 2: 3x11

## **Head Mount:**

- Piece 1: 10x15
- Piece 2: 7.5x15

## **Size Adjustment:**

- Piece 4: 14x15
- Piece 7: 4x3
- Piece 5: 5x3
- Piece 6 (x4) 1.5x7

# Tips For Using a Hot Glue Gun

Rather than holding the trigger on the glue gun down, pump it in and out as you move along the line that is to be glued. This will increase the amount of glue that comes out of the gun.

Do not touch or disturb the glue when it is drying as this makes it much weaker and less likely to last a long time

Keep in mind how much glue is left in the gun and be ready to restock quickly if you are gluing a large area. For example you could have an extra glue stick next to you as you are gluing just in case.

## Step 2: Cut Aperture

Cut a 1 inch cross length diamond with its leftmost point at the midpoint of the 16 inch side (on the 15x16 side), 4 inches down from the 16 inch side

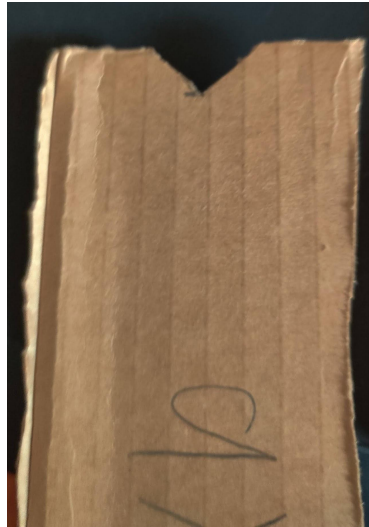




## Step 3: Assemble the aperture slider

Cut half of the aperture diamond into the end of the 9x3 panel

Cut a 3x3 square out of the middle of the short end of the 6x9 panel

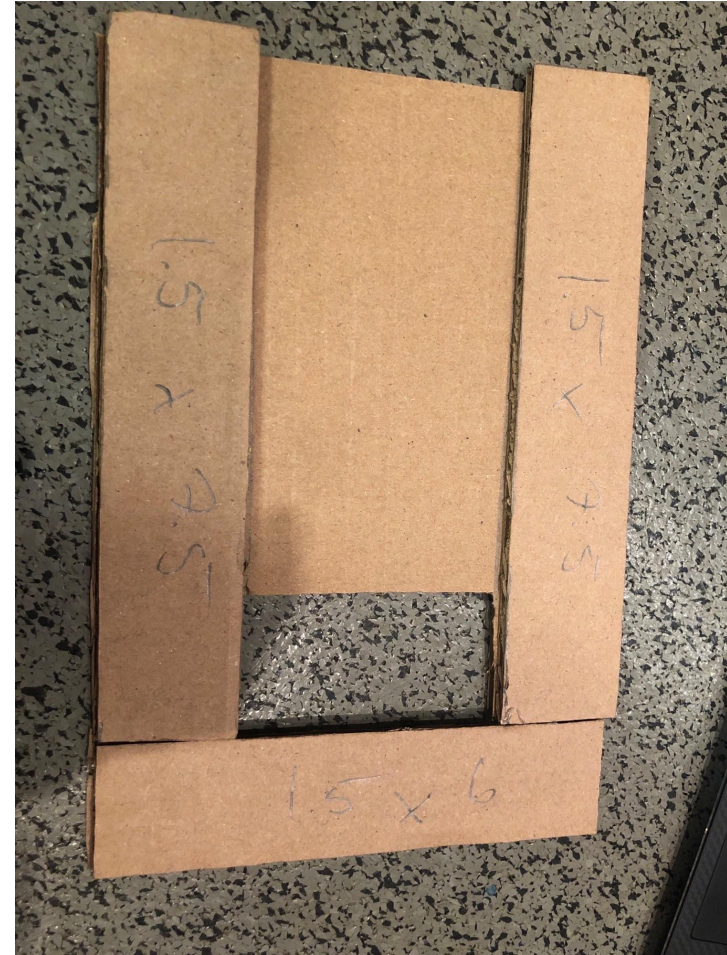


## Step 3.1: Aperture Construction

Place the 7.5x1.5 panels parallel, with their ends touching the 6x1.5 panel and their outer long edges aligned with the short edges of the 6x1.5

Place the 6x9 panel on top, with the edges aligned and the 3x3 hole on the side with the 6x1.5 panel

Then, fasten this assembly together using tape/hot glue

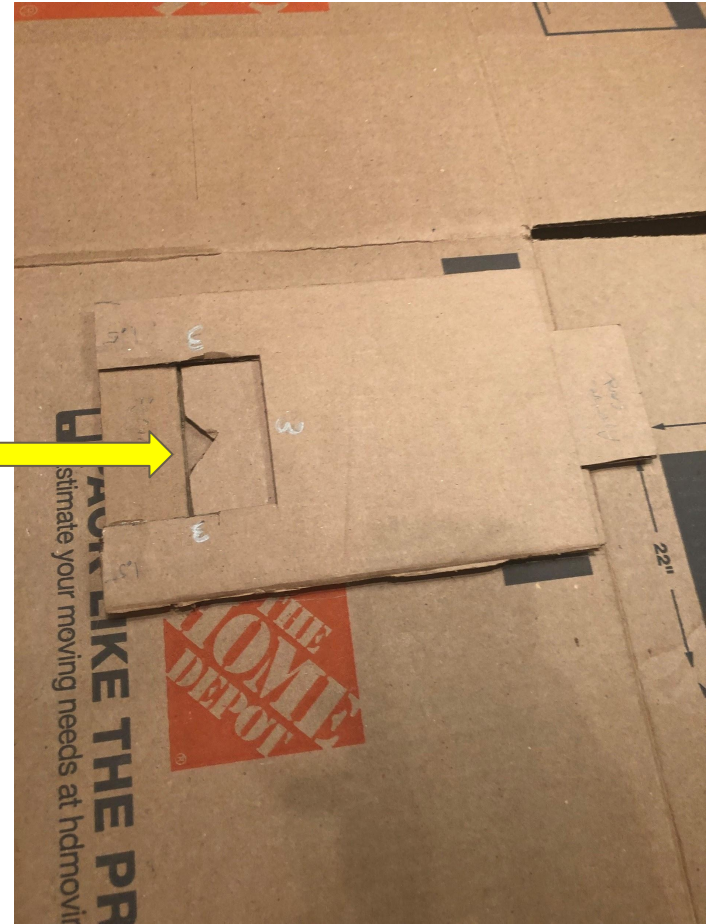


## Step 3.2: Aperture Mount

Find the aperture hole cut earlier and align the box so the edge closest to the aperture is on the right side

Align the midpoint of the interior barrier 0.5 inches from the left side of the aperture diamond

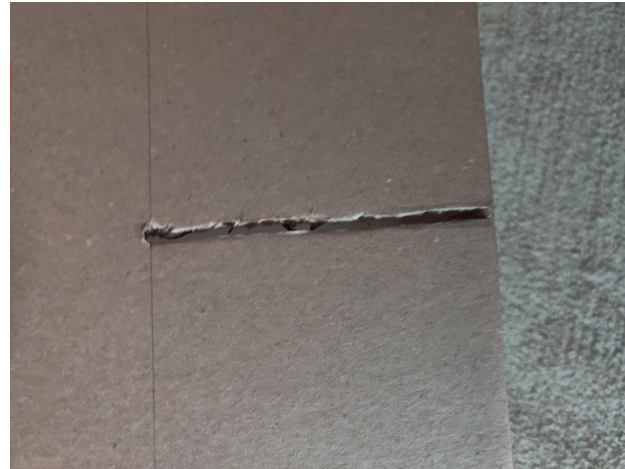
Trace around the aperture assembly and then glue it on via the inside of the trace lines



# Step 4

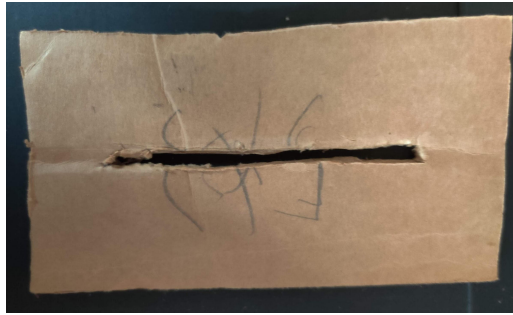
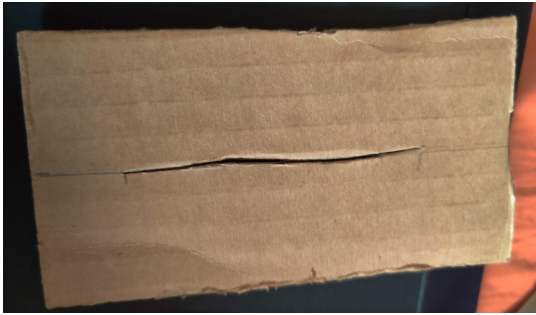
Assemble the size adjustment slider

Cut a 5 inch slot on the 16x22 side. The slot should be cut from the center of the 16 inch side that is furthest from the one the aperture is next to (across the hypotenuse of the box)

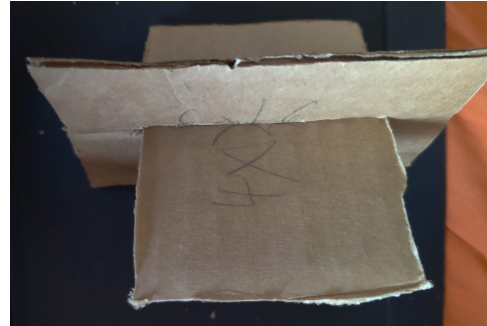


## Step 4.1: Handle Assembly

Cut a 3 inch slot in the center of the 5x3 panel, aligned with the long side



Then insert the 4x3 panel into the slot



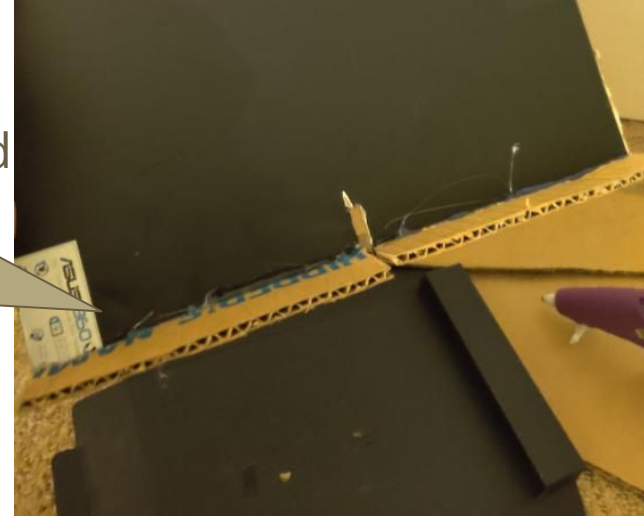
## Step 4.2: Screen Construction

Flip to the 14 inch side of the 14x15 inch cardboard rectangle and cut a perpendicular slot in the middle of said side with a length of 1.5 inches

On the same side, the 1.5x7 inch segments are glued vertically on the long axis of each piece.

This done on the opposite side of the 14x15 panel. (picture in **step 4.3** shows this)

Tape the 8.5x11 paper highest point possible on the 14x15 inch rectangle. The paper is taped on so that the long side faces up



## Step 4.3: Screen + Handle

Insert the screen assembly into the box with the slot/panels on the bottom ( slot is aligned with the box slot)

Then, insert the handle into the box slot with the 4x3 piece ( 3 in end first), so that it goes through into the screen slot. Align the center with the slot and then glue the two pieces together. On the outside, slide the 5x3 piece so it is flush with the box and glue in place.



## Step 4.35(Optional): Duct taping to darken the inside

Take a piece of duct tape of around 4 inches, then take a 2 inch piece and stick to the underside of the piece, 0.5 inches from one short side. Then, tape the exposed 0.5 inches onto the slider, and the other exposed part at the end of the slot with a piece of tape across it. This should help prevent light pollution and improve image clarity.





# Step 5: Head Mount Construction

Take 7.5x15 rectangle and cut out the middle rectangle displayed to the right

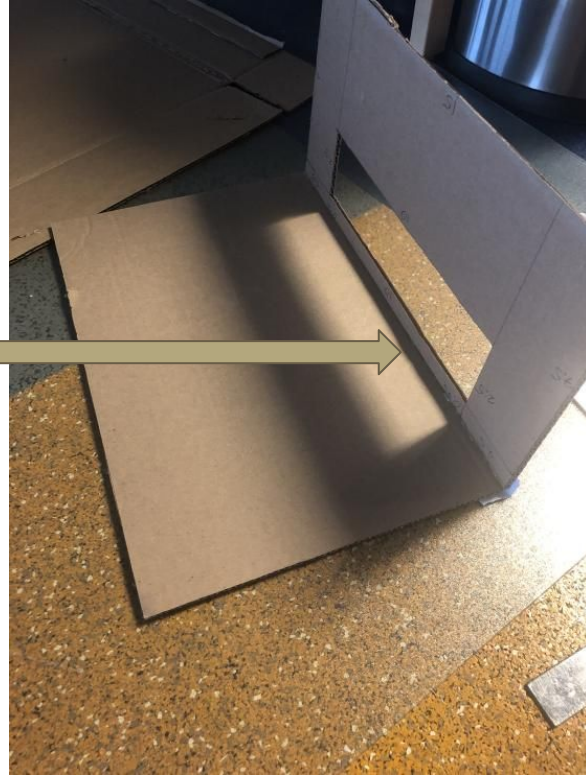
Replicate the dimensions on the rectangle before you cut



## Step 5.1: Head Mount Construction (cont.)

Take the long side of the 7.5x15 and glue it vertically to the 10x15 rectangle.

If needed, duct tape can be used to reinforce the seam between the two pieces.



## Step 5.2: Head Mount Installation

Mount the head mount assembly from before inside the box with the rectangle cut out facing the screen.

The relationship between the two is seen in the image to the right.

If not already, fold the box together completely using tape and hot glue where necessary



## Step 5.3: Cutting the Head Hole

Flip the box over so the slider handle is on the far side of the box. (seen in image)

From the other side (side closest to camera angle in picture) measure 2.5 inches in from both the left and the right edges and then 10 inches towards the slider handle.

Connect the two 10 inch lines together to form a 10x10 square. Cut the square out.



## Step 6: Seal the Box

Make sure it is a bright, sunny day before testing the light leakage. If bright outside, place the camera obscura over your head. Notice any holes, gaps, or glue seams that have light leaking through them. After finding all light gaps, take the camera obscura off and seal the gaps, holes, or glue seams with a strip of duct tape. Continue this process until the only source of light entry is via the aperture. The better light-sealed the camera obscura is, the sharper and better the image on the screen will be.



# Step 7: Cloth and Head Hole

Cut a 12x12 piece of cloth/flexible plastic using scissors

Place this over the head hole so there is an inch of extra material on each side (Fold over the edge of the box)

Place a line of duct tape over the outside edge of the cloth ( half on half off), making sure it is under a bit of tension before taping (just before the point of stretching)

Then, cover the entirety of this cloth in duct tape (Only necessary if fabric is not strong or is not opaque) (Optional to double up with perpendicular strips)

At this point, cut a cross (using a knife to puncture and scissors to cut) at the center of the hole. This should extend all the way to the edges



## Step 7.15(Optional): Additional Cloth

Cut four 6x10 inch pieces of cloth/flexible plastic using scissors

Place horizontal strips of duct tape on each of the pieces, folding over the edges (Only necessary if fabric is not strong or is not opaque) (Optional to double up with perpendicular strips)

Attach each piece using tape on both sides of one ten inch side. The bases should form a 10x10 square on top of where the head hole edges were. (Depth of 6 inches)

Then, lift the pieces up and use a vertical piece to attach them at the corners, folding it over the top.



# Testing Plan

Factor to test	Testing procedure (Must be done on a bright day, outdoors)
1. Light Tightness	1. Put it on, see how much light gets in and where. Add tape accordingly
2. Aperture adjustment	2. Assuming it works, move aperture to ascertain that it effectively adjusts image quality/brightness. (While on head)
3. Size adjustment	3. Make sure the size can be changed via the slider without issue (While on head)
4. Image Quality	4. Put it on, is the image clear enough to be visible and distinguishable (Try to adjust aperture, image may be a bit blurry but you should be able to understand what you're looking at.
5. Wearability	5. Can you put the camera on? Does it fit comfortably? Does it fit other people?



# Directions for use: General Instructions

The camera obscura works best on a bright sunny day. Line up the image you want to see by aligning the aperture hole in the direction of the object. Once aligned, to use the Camera obscura, place it over your head, allowing your head to enter into the head gap. A flipped image of the object should appear on the 8.5x11 inch paper screen. This image is live, so by moving your head, the image will change in real time.

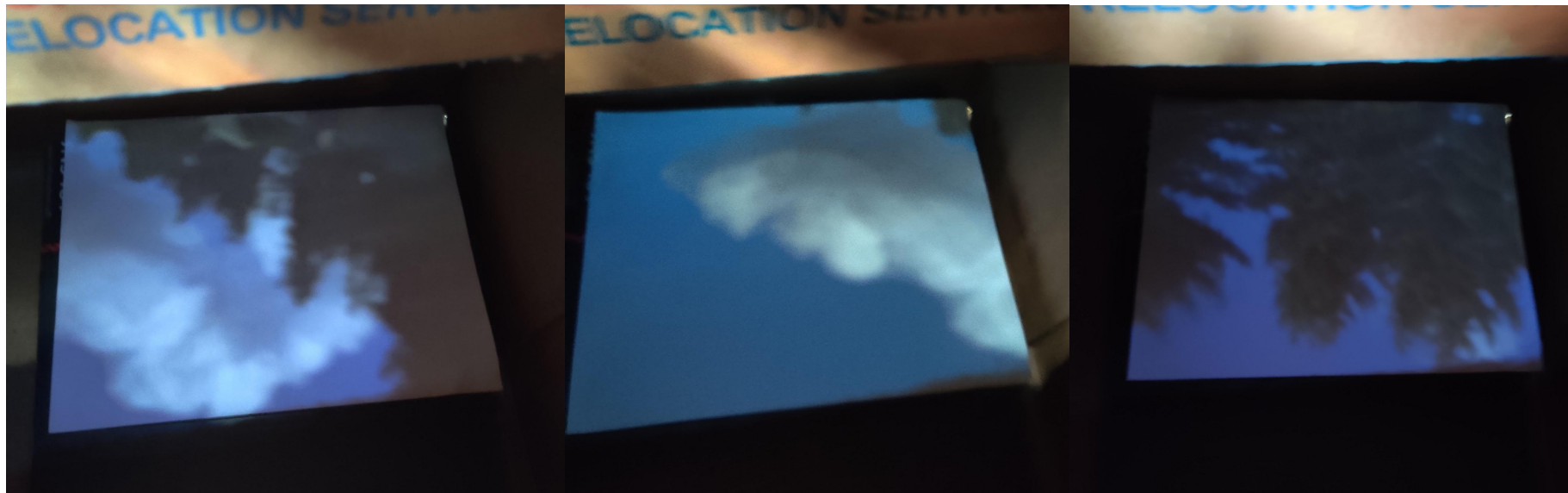
# Directions for use: Aperture Adjustment

The aperture adjustment card is located on the backside of the box on the right side. To use it, grab it with your right hand while keeping the left hand on the box to keep it stable. Adjusting the aperture card back and forth changes the amount of light that can enter the box and show up on the screen. If the image is too bright, move the aperture card farther into the box, making the diamond hole smaller. Do the opposite if the image is too dark. The camera obscura only works if the aperture diamond hole is unblocked and light can pass through. Small adjustments may be necessary to pinpoint the best image possible.

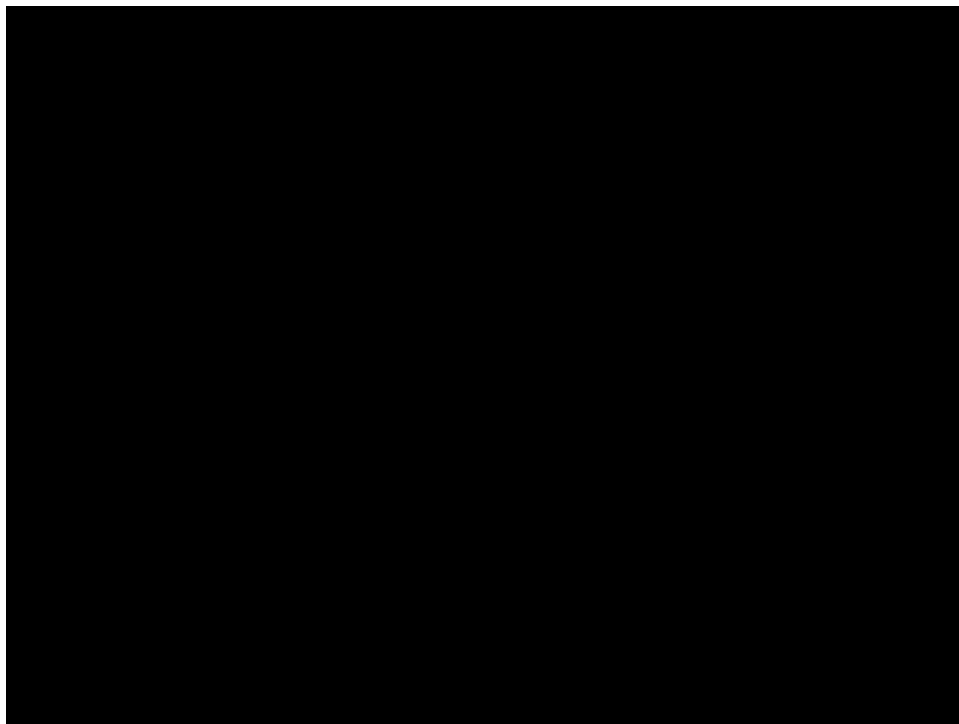
# Directions for use: Size Adjustment Slider

The size adjustment slider is located on the bottom middle directly in front of you. When using the slider handle, grab it with one hand (does not matter which one) and use the other hand to stabilize the box. The slider moves closer and farther away. Moving it closer causes a singular point in the image to get larger while moving it away causes the opposite effect. To get the image desired, small adjusts may be necessary. If the slider is too hard to move, take the camera obscura off and move it back and forth quickly, widening the gap in which it can move. Do not do this too much or the slider will not be as precise when it is moved.

# Example Images



# Video of Camera Obscura in Action



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**— Thanks for building —**

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