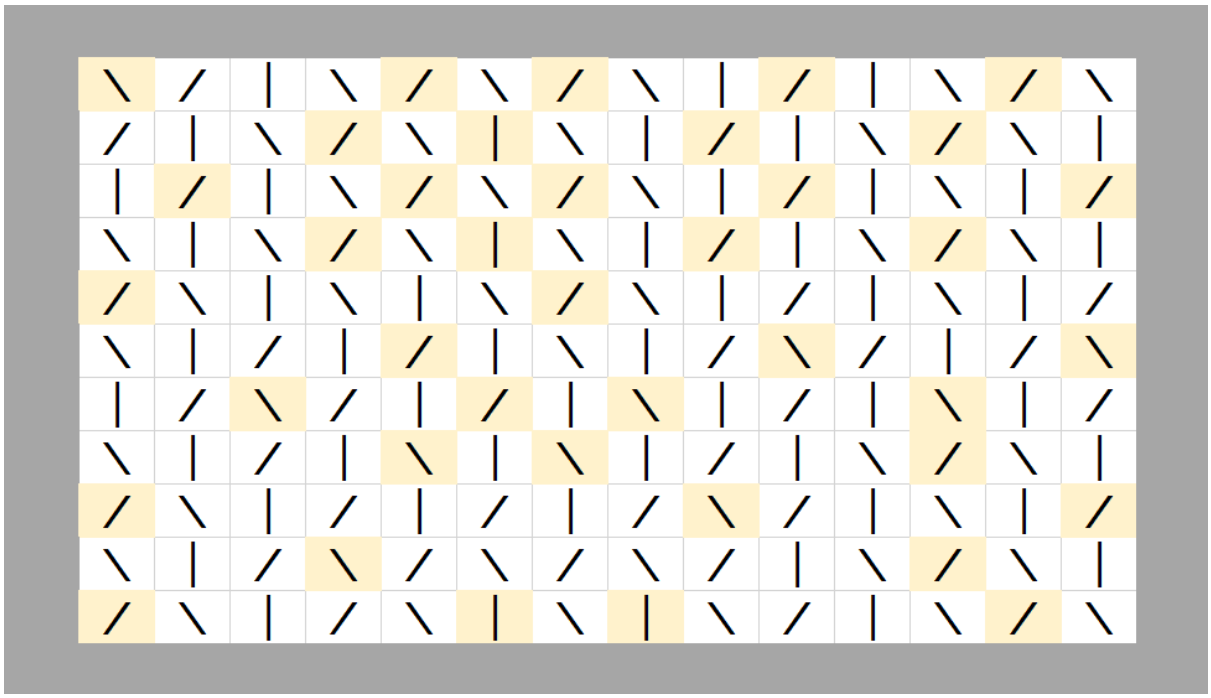
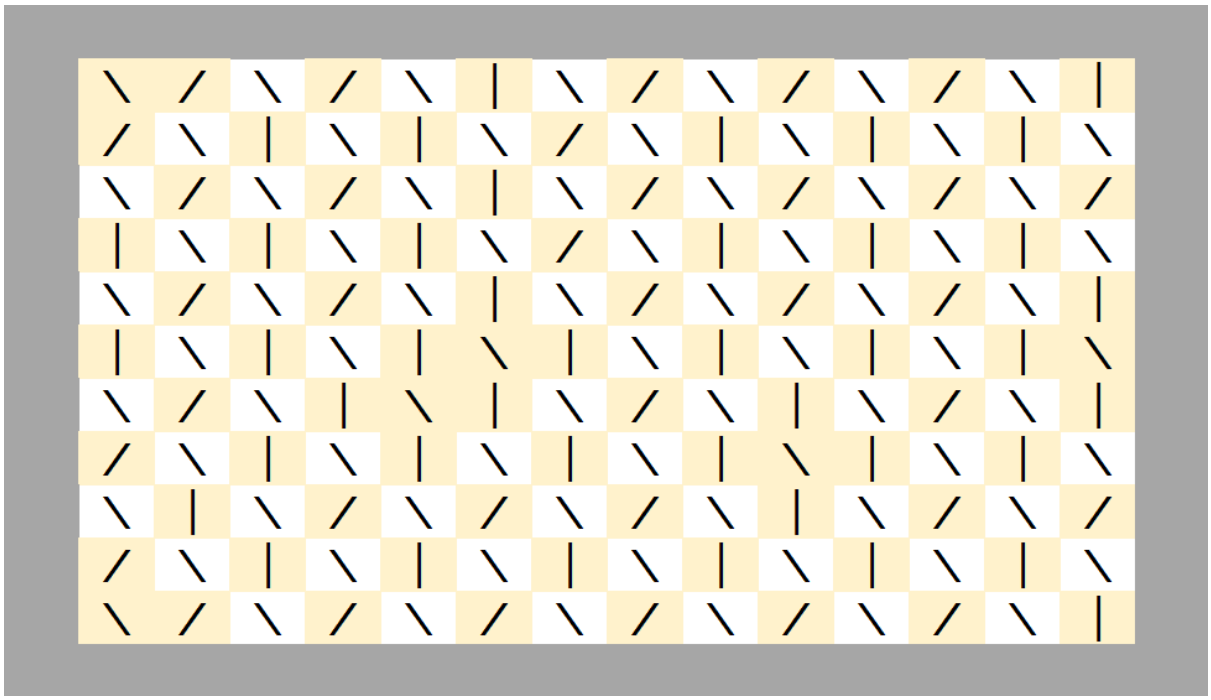
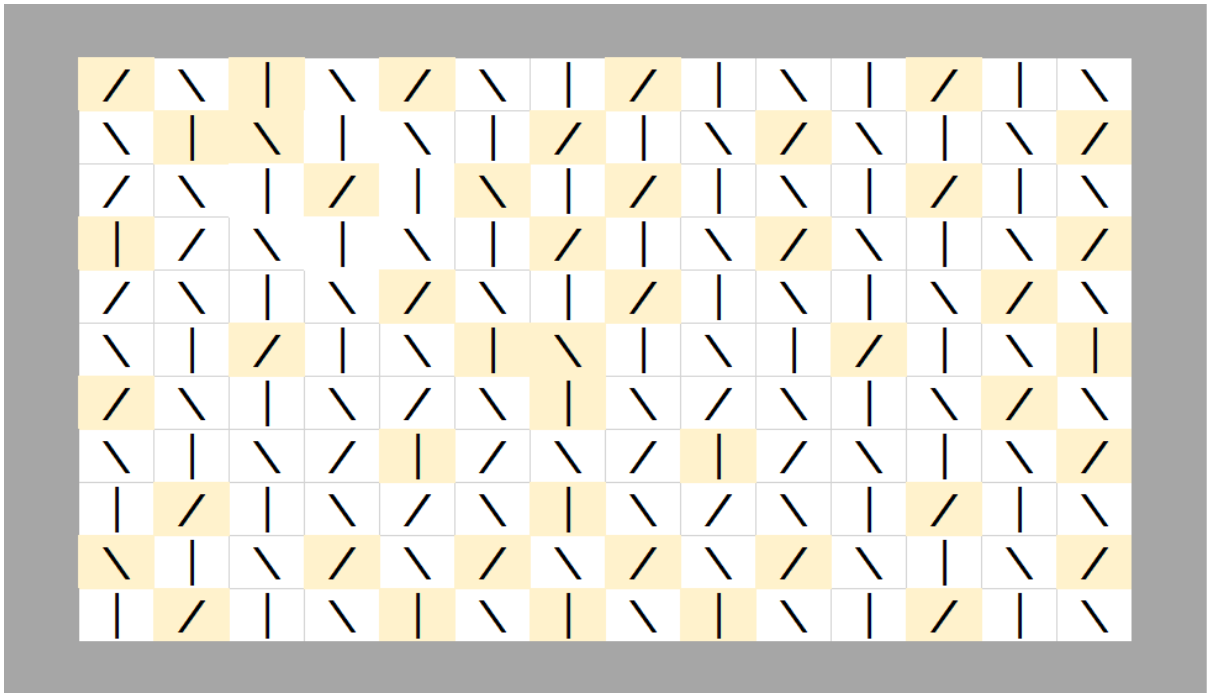
Displacer Beast (solution)

by Ong Kah Kien

The given grids represent 3 malfunctioning viewfinders with each cell (pixel) being polarized along one of the 3 given axes, which is offset from each other by 45-degrees or 90-degrees. Given that none of the cells are orthogonally adjacent to another with the same axis, the first step is to infer the polarized axis of all the other unknown cells. The full arrangement of the polarized axes of all the 3 grids are shown below (the given pixels are highlighted in beige):







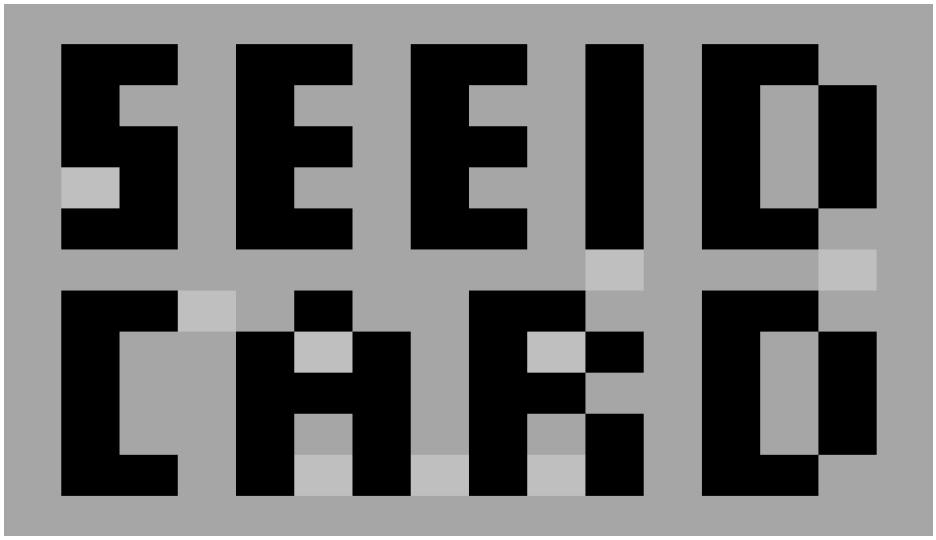
After this is done, the next step is to overlay the 3 grids (viewfinders) in the given order as instructed. A polarized lens only allows light to pass through along its polarized axis. There are 3 possibilities when overlaid with another polarized lens:

(i) If the polarized axes are parallel/the same, the intensity of the light passing through the second lens is the same as intensity that passed through the first lens (100%);

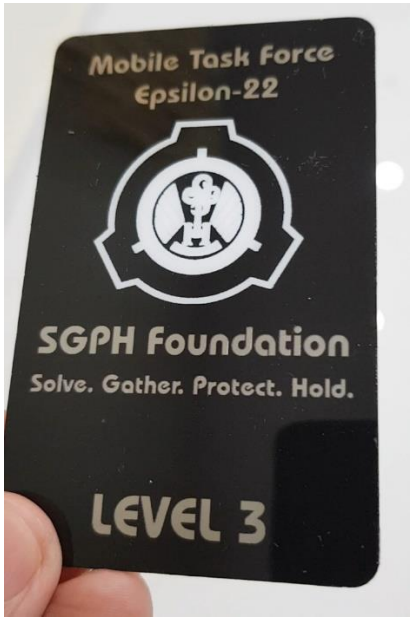
(ii) If the polarized axes are at a 45-degree offset, the intensity of the light passing through the second lens is half the intensity that passed through the first lens (50%); or

(iii) If the polarized axes are perpendicular/at a 90-degree offset, the second lens completely blocks all the light passing through the first lens (0%).

This follows Malus's law. And the third lens will have a similar effect on the remaining intensity of light that had passed through the second lens (if any). So relative to the intensity of the light passing through the first lens, the final intensity of the light in each pixel after overlaying all 3 viewfinders could be either 100%, 50% (light gray), 25% (dark gray), or 0% (no light or black). The resulting light image is shown below:



The resulting light image shows the clue phrase SEE ID CARD. Before the hunt, each team is mailed a hunt pack which includes a SGPH Foundation ID card for each team member. The card looks like just a thematic hunt souvenir, as shown below:



But as instructed by the clue phrase, a closer inspection of the card using a polarized lens will reveal colored letters instead. Here is how the actual card looks under a polarized lens:

Here are the images of the ID card as seen normally and under polarized lens in a side-by-side comparison:

Most of the colored letters are yellow, but there are also a few green letters which form the thematic answer for this puzzle **BLINDING**.

Constructor's notes:

When brainstorming for a puzzle idea with the answer as the starting point, I naturally gravitated towards a light and color-themed concept. This eventual idea of overlaying polarized grids was inspired by a 2014 MITMH puzzle by Chieu Nguyen. I came up with a new twist that each cell in the grid had a different polarized axis, and also managed to fit this into the context of the story. Because an easier and shorter puzzle is par for Round 1, the grids would be solved for directly instead. The method is using a simple but interesting successive logical inference process, based on some initial given cells. It was a pity that the second grid needed to have a large number of givens, because cells which formed the clue letters had to have a diagonal axis in this grid in order to be blocked out completely. The construction of the grids turned out to be pretty challenging due to these various constraints, and took a few weeks and several attempts. I also didn't want to have cells that had 100% intensity (as they would also stand out and could be red herrings). However, I was okay to have the few odd cells with 50% intensity, so as to be able to reduce the number of givens and make the logical inference tasks more challenging and interesting instead. The final step to make use of the hunt physical souvenir has always been planned, although it was quite fortuitous to chance upon a thematic way to use a polarized lens to view a hidden answer. However, the customization and production process was not trivial, as such hidden polarized images can always still be seen faintly, especially when similar cards are viewed from an angle. So significant time and effort was spent to find a way so that the answer could be hidden as best as possible, and not spoil the surprise for solvers who may suspect that the souvenirs could be used as puzzle elements and inspect them closely.