## The Blind Spot and the Night-Blind Spot

The retina is not uniform across its surface. There are areas of greater and lesser cell densities, there are areas of higher and lower ratios of rod to cone photoreceptor cells, and there are a variety of other distinctions. Two of the most dramatic are the "blind spot" and the "night –blind spot".

Demonstrating the blind spot:
This is the region where the optic nerve exits the eye.

Cover your right eye with your hand and hold each of the three images about 12" in front of your face. Gaze at the object on the right and slowly move the image closer or farther away until:

The dot disappears

The space in the blue bar appears solid

The hole in the grid of vertical lines disappears

Demonstrating the night blind spot:
This is a region called the fovea. Go outside on a clear night and gaze directly at a dim star. You'll see that it disappears, but if you look to one side of the star it reappears.

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*Why do these phenomena happen?*

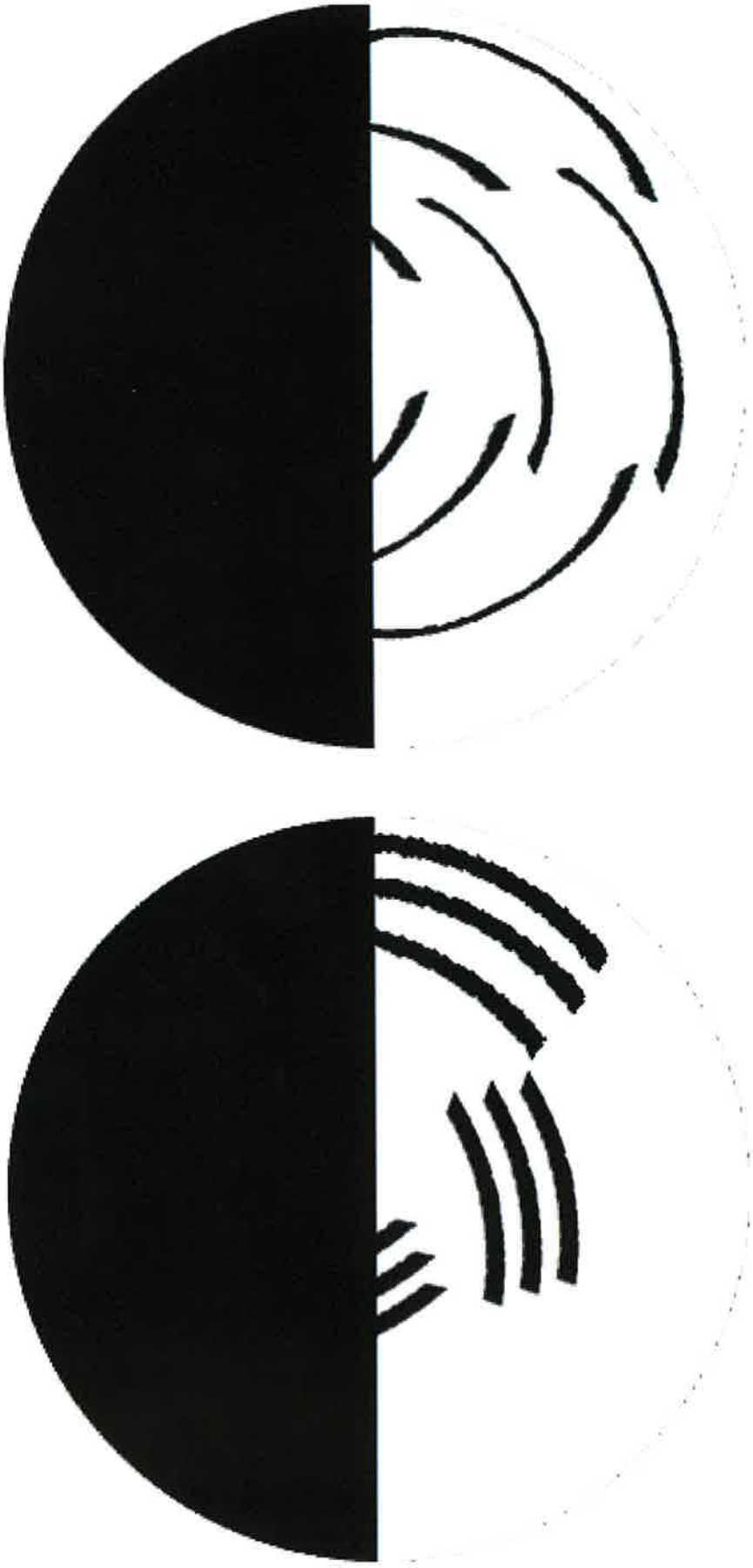
The blind spot:
This is the region where the optic nerve exits the eye. Because the optic nerve is made up of ganglion cell axons, and ganglion cells are on the inner surface of the retina, all of these axons gather together at one spot and dive down through the retina to exit the eyeball. Therefore, none of the cells responsible for vision exist at this spot. There are no rod or cone photoreceptor cells in this region of the eye, so there is effectively a hole in the sensor array.

***Questions:*** Why doesn't this work with both eyes open? Why doesn't it work with the left eye covered?

The latter two examples demonstrate that information processing in the brain "fills in" the missing information from the blind spot. This is why we don't continuously recognize an empty space in our visual field.

The night blind spot:
The fovea is a spot on the retina aligned with the central axis of the eye, and it is our region of highest visual acuity and best color vision. Because we are diurnal animals, the fovea contains only cone cells which operate best under bright light conditions, and because they are small, they pack densely to provide high resolution vision.

***Question:*** Why does this only work with dim, point sources of light?



## Benham's Disk:
## *Color from nothing!!!*

Invented in 1894 and sold as the "Artificial Spectrum Top", Benham's Top or Benham's Disk still remains a mystery.

Method:

- Cut out the patterns (or make your own and cut them out)
- Mount to stiff disk such as a plastic container lid
- Make a hole in the center and insert a toothpick
- Spin and watch visual magic happen!

Possible explanations:

1. White and black areas activate different areas of the retina depending upon the pattern. Some type of interaction among these areas during information processing may cause the perception of color.

2. Different types of cones take different lengths of time to respond, and stay active for different lengths of time. The different patterns lead to different time sequences of black and white alternation and so may activate specific cone types.

3. Rod cells, non-responsive to color, sometimes send their information through cone cells (responsible for color) to reach other processing neurons. Activation of these cone pathways by rods may lead to perception of color.

*Much of retinal and brain visual information processing remains unknown.*