Visual Illusions Laboratory

Background:

Visual illusions occur when you 'see' something different than that which is *physically present* in a picture. Playing with visual illusions is great fun and provides a fascinating glimpse into how your eye and brain alter the content (information) physically present in a picture so that you perceive something which is not 'really' there!

There are many explanations or theories of why we see visual illusions. Different illusions have differing causes. In the class presentations we will discuss some of these theories, but we will also say that scientists can presently not full explain all visual illusions.

In this laboratory you will be collecting data to measure actually how big of an [mis]perception is caused in an illusion. With the help of your TA you will also be able suggest changes to the illusory 'picture' and then remeasure the illusion to see if the factors you have suggested affect the size of the [mis]perception.

The Illusions:

We have programmed three illusions for use in this laboratory. They are described on the next three pages of this handout.

You may also tryout these illusions using the CfAO/COSMOS WWW page:

Students' responsibilities:

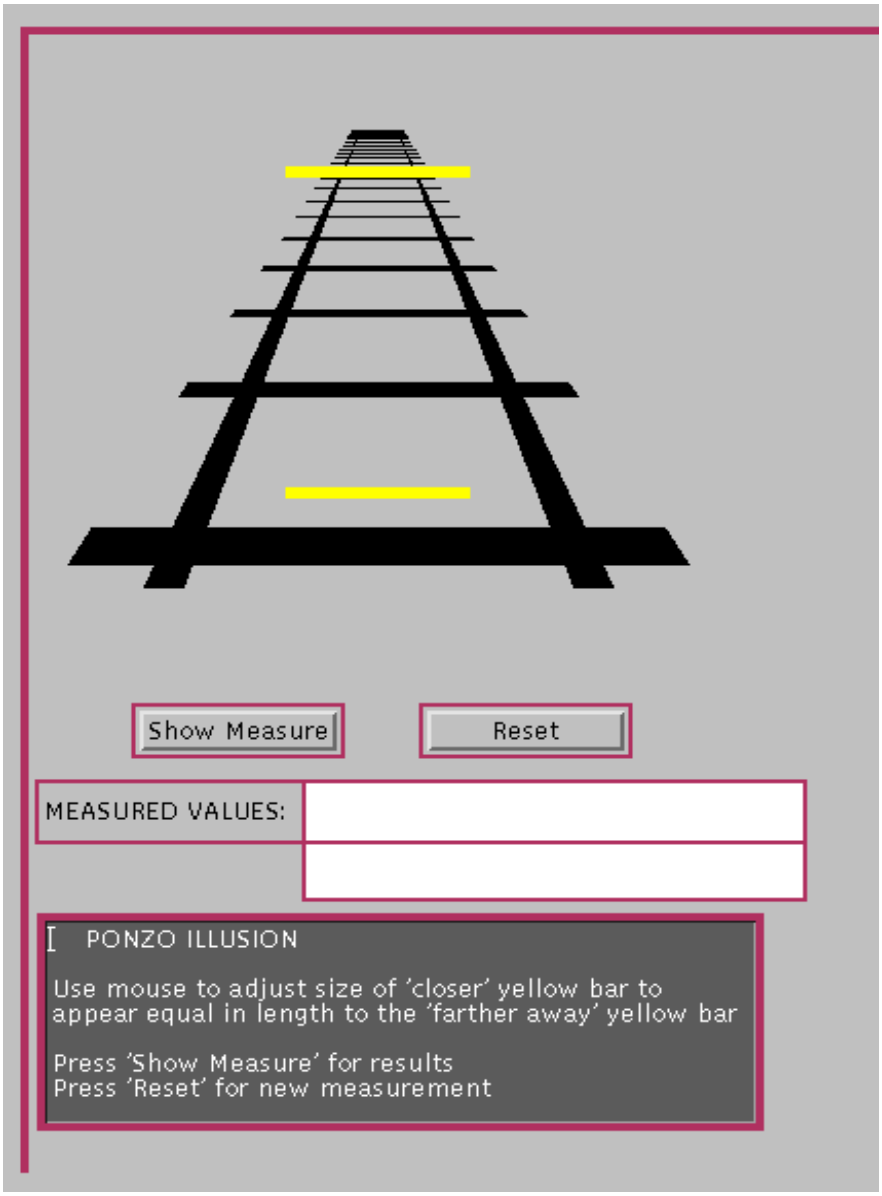
These experiments will be a part of the laboratory sessions on the afternoons of July 10th and 17th. All students will participate in this lab.

- Students who select this as their COSMOS reseach project will be the 'experimenters' who collect experimental data. They will meet with the TAs during afternoon research sessions for help in setting up the experiments, in analyzing data, and in preparing their COSMOS presentation. During the labs essions they will be responsible for 'running' the experiments to collect data.

- Students doing other COSMOS research projects will serve as 'subjects' for the experiments. During the VISION lab sessions they be asked to make measuresments for the illusions.

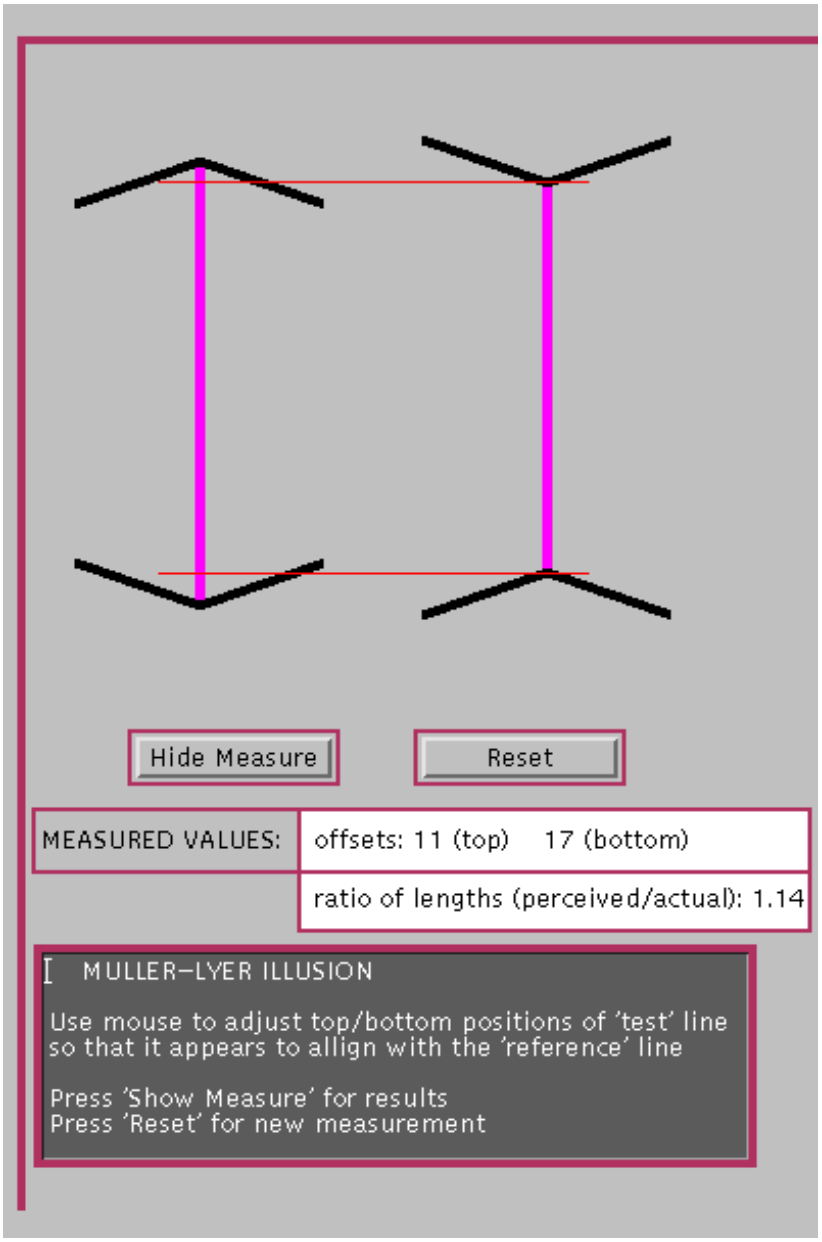
Ponzo Illusion

The experimental setup for the Ponzo Illusion is pictured below:



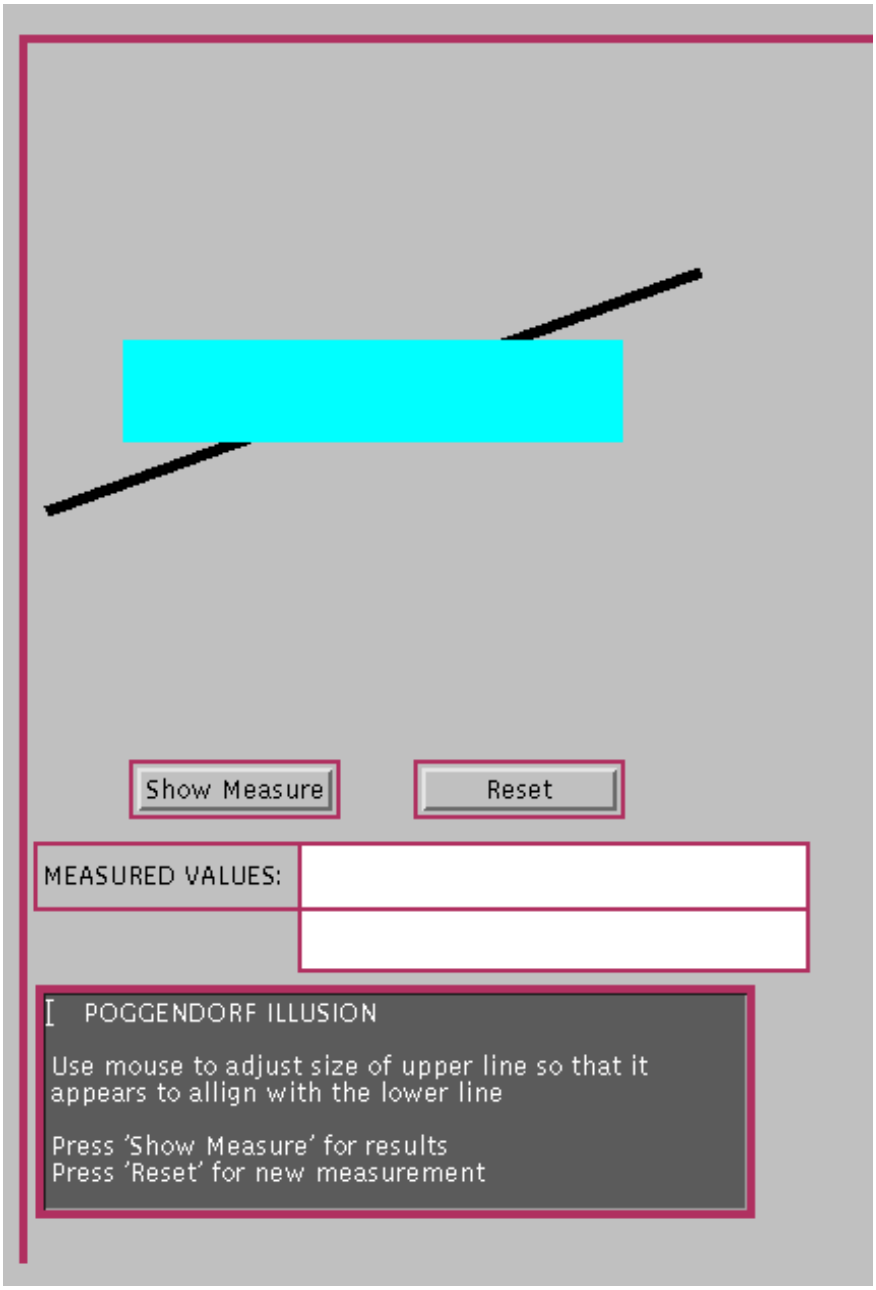
In this illusion the railroard tracks, which appear to go off into the distance, make the lower yellow bar look shorter that the upper one. They are actually the same size!!!

The Muller−Lyer Illusion



In this illusion, if the two magenta vertical lines were the same length, the vertical line with 'arrowheads' would look longer than the one on the right with 'fins−out'. In this picture a subject has adjusted vertical line on the left to 'appear' just a long as the one on the right. When he pushed the 'measure button', WOW he had made the one on the left *physically* longer for the two lines to *appear* the same length. What features in the picture could be changed to affect this [mis]perception????

The Poggendorf Illusion



In this illusion the black lines above and below the cyan rectangle do not appear to be in a direction which would meet!! However, if the rectangle is taken away one would see that they are actually part of the same line. Subjects will adjust the upper black line until it 'appears' to allign with the lower and then the 'show measure' button will indicate how far they *physically* miss one another to be *perceived* as part of a straight line.

For students who are doing ILLUSIONS for their COSMOS research project:

Doing the experiment:

Preparation:

- Meet with your TAs on Monday, July 9th, 2:15−3:45 to discuss and setup experiment.
- Select two of the three visual illusions (Ponzo, Muller−Lyer, Poggendorf) to be the topic of your research project.
- Discuss with the TA possible 'theories' of why these illusions occur.
- With the help of the TA, for each illusion suggest two changes which might effect the appearance of the illusion and thus change the size of the illusory effect. The TA will then work with you to reprogram the "JAVA APPLET" so that you can change the features of the illusion (see page 6 for example).
- Consider how to setup pages in your notebook to collect the data and what data to collect (see below).

Doing the experiment:

- During the VISION lab sessions (July 10th and 17th) you will collect data for your projects. These tests will be carried out on conputers in room 104 Sinsheimer, but you will also be able to access the experiment from and WWW computers.

  Here's the skinny on what you will do as the 'experimenter' (you also have leeway in planning your own experiment)

  ♦ For the two illusions you choose, pick two values of the features you wish to vary (for example color, angle, etc.) to give you 8 experimental conditions.
  ♦ Your COSMOS classmates will sign up as subjects for your experiments during lab time on July 10th and 17th and you will ask them to make measurements for each of the 8 conditions. You should decide the following:
  i) What data should I record? How should I setup my notebook to record this data?
  ii) What order should I present the various conditions?
  iii) Should I have each person make one measrement, or several, for each condition?

Data work−up:

- The TAs will be available on 13th and 18th July to work with you on data analysis and preparation of your COSMOS presentation
- For each of the experimental factors you measure you should calculate the mean and standard deviations by methods which the TAs have taught you in a Research Session.
- You should analyze the data asking the following questions (and others that you can think−up:
  ♦ Does your data quantitatively indicate the illusory effect? Is it statistically significant? Is it similar for every experimental subject?
- ♦ Did changing the values of some parameters affect the size of the illusory effect? Did they change in a way that supports a theory of what causes the illusion?

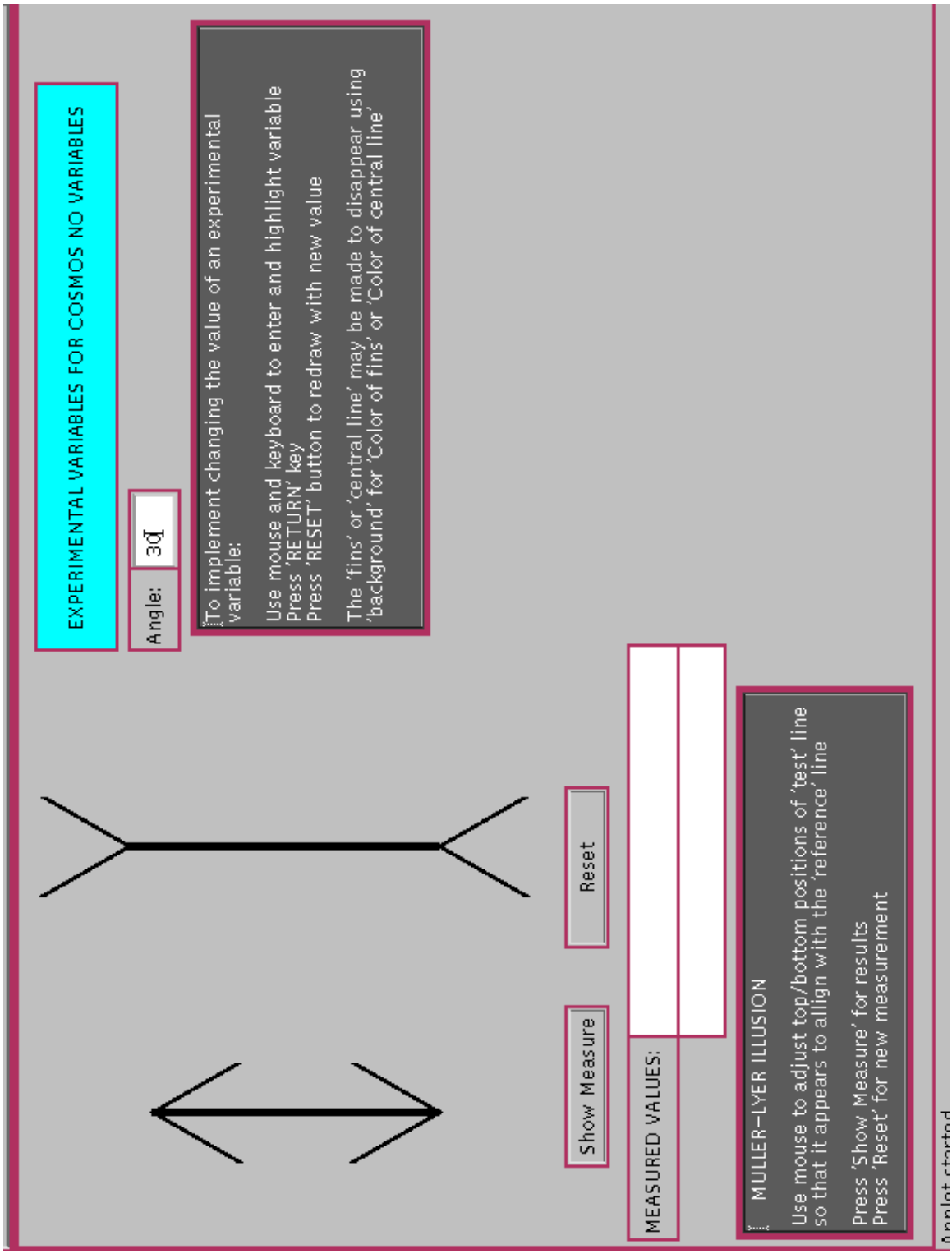
Presentation preparation:

On the afternoon of July 20th, you will be giving a presentation to the COSMOS module. You will have worked on the presentation in your Communication Classes and will have prepared graphs and text for the COSMOS WWW. For your presentation you are encouraged to think of all sorts of neat ways to talk about your project. For those of you selecting Illusions for you COSMOS project here are some ideas about topics which might help you organize your presentation:

- What are illusions in general and why are they valuable in understanding how the visual system works?
- Describe the specific illusions you have studied.
- What are theories about the causes of the misperception in the illusions?
- How and WHY did you select certain parameters to change in studying the illusion.
- What were your experimental findings.
- What can you say about your results and the cause of the illusion?
- What would you do differently if you were doing the experiment again?

Changing Factors in the illusion:

For example you might suggest to change the color of part of the ’picture’, like the rectangle or the lines in the Poggendorf picture. Another example would be choosing the angle for the "arrowheads" in the Muller−Lyer. On the next page we show how you and the TA could alter the Muller−Lyer Applet to let you specify what angle the "arrowheads" would have:


EXPERIMENTAL VARIABLES FOR COSMOS NO VARIABLES
Angle: 30
To implement changing the value of an experimental variable:
Use mouse and keyboard to enter and highlight variable
Press 'RETURN' key
Press 'RESET' button to redraw with new value
The 'fins' or 'central line' may be made to disappear using 'background' for 'Color of fins' or 'Color of central line'
Show Measure
Reset
MEASURED VALUES:
MULLER-LYER ILLUSION
Use mouse to adjust top/bottom positions of 'test' line so that it appears to allign with the 'reference' line
Press 'Show Measure' for results
Press 'Reset' for new measurement
Applet started