CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Melissa K. Hoffman

Project Number
J0316

Project Title
Being Broad Minded: Effects of Size of Angle and Apparent Depth on the Ponzo Illusion

Abstract

Objectives/Goals
In the Ponzo illusion, the angle of converging lines in the background creates apparent depth through linear perspective, causing people to see two equal, horizontal lines in the foreground as different sizes. I hypothesized that most people should see the illusion at moderate angles of perspective when apparent depth would be strong and few would see the illusion as the converging lines reach 0 or 180 degrees because the vanishing point effect should gradually disappear.

Methods/Materials
A total of 92 test subjects were shown Ponzo illusions where the angle of the converging lines increased in ten-degree steps from 0 to 180 degrees. Subjects were asked to determine whether the test line (upper horizontal line) appeared to be larger, smaller, or equal to the reference line (lower horizontal line). Controls were similar to tests but the diagrams had no converging lines as depth cues.

Results
At 10 degrees most (80%) test subjects saw the illusion and almost all test subjects (97% to 99%) identified the test line as larger through 110 degrees. Fewer than 5% saw the illusion when the test angles were greater than 120 degrees. No illusion was seen by any test subject at angles of 0 and 180 degrees. By comparison, all controls tested 100% correctly. Thus, the Ponzo illusion was seen to work over a broad, 100-degree range of angles for the converging lines.

Conclusions/Discussion
The data supports the ideas investigated here and by other scientists that depth cues are responsible for creating the illusion. Specifically, our ability to correctly identify the size of an object near and far (size constancy) makes the top horizontal appear far away and therefore larger. However, previous studies did not test over a broad range of angles, and this experiment suggests it would be good to do so to better understand the role linear perspective plays in creating apparent depth. We take for granted the ability to see the world in three dimensions and to perceive distance as a normal activity but depth perception is clearly complex.

Summary Statement
I demonstrated that the Ponzo illusion works over a broad, 100-degree range of angles where apparent depth is caused by misleading cues in linear perception.

Help Received
Father took me to UC Berkeley and Stanford to find original scientific citations; Mother proof-read paper; Parents got permission to give tests at workplace; 7th grade Science Teacher provided general supervision.