Introduction

Previous research on 3D slant perception has demonstrated that humans have strong abilities to estimate slant from objects, however, humans still struggle in certain conditions to perceive slant. Additionally, researchers have investigated the way in which humans combine various environmental cues to perceive depth with one approach being the Bayesian Maximum Likelihood Model and the Intrinsic Constrain (IC) Model.

The idea that humans struggle with 3D perception at times based on the results of these studies can be attributed to the fact that the typical laboratory environments running these studies produce various cues to flatness that might create a bias for the observer. For example, there can be blur gradients around the stimuli that will indicate flatness, but also the monitor screen itself gives cues to flatness. These cues to flatness can affect the way observers are perceiving depth, which makes it important that real physical stimuli are used to investigate human slant perception. Additionally, as a result of being in a physical environment and perceiving real objects, observers will perceive more depth given more visual cues and become more veridical in their perception. James J. Gibson supports a theory of direct perception that humans are accurate perceivers of depth given their environment and understanding the relationship of objects within their environment. Accurate perception results from not being able to derive an absolute depth, but to perceive a depth that allows one to perform an action or complete a task.

This study investigates (1) the veridicality of human depth perception given real physical stimuli and (2) the way humans might integrate these cues to determine depth.

Methods

Participants:
- 7 Brown University undergraduate and graduate students
- All had normal to corrected vision
- All tested for stereoscopic vision

Experimental Design:
Objective: Participants view real physical stimuli and generate an estimate of depth.

- Probe task
- Randomized order of conditions presented

Variables:
- Independent Variable: the test stimulus or the real physical 3D objects
- Dependent Variable: the probe stimulus

Results

All participants included passed the stereoscopic test. Four participants were excluded from the data, one from the pilot study and three from the Main Experiment due to their inability to see the stereo conditions. After conducting repeated measures ANOVA, there were significant effects found in each of the four levels $\left[F(3,18) = 17.94, p=0.0000121\right]$. These four levels include the different slanted degrees of simulated depth (16, 30, 45, 60). After conducting two t-tests, I found that there was a significant difference in the scores for the combined cue condition and the single cue condition; $t(6)=-2.6603, p=0.03751$. Given more cues, participants began to see more depth from slant. Additionally, participants were more veridical in their estimations of perceived slant as you can see from the increased in perceived depth over conditions. The control condition is also expected with no depth being seen.

Conclusion

Results suggest that, despite inaccuracies in perceived depth in certain conditions from previous research on this area, humans are actually veridical perceivers of depth, specifically when viewing real physical 3D stimuli. The results also suggest that humans might follow a more deterministic approach to combining cues in order to perceive depth. This approach most closely aligns with the IC model in which humans will begin to perceive more depth upon more cues being available to them in viewing conditions. Overall, these findings are important in addressing the viewing environment psychophysical experiments are conducted in and what the future of stimuli generation and experimental environment might look like.