Course: VR Systems and Humans

Assignment 4.3

Report from The Rat Lab

Group: #9

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1. Hypothesis for Color Perception

Test questions:

1) How well do people estimate colors in the shadows of objects in a room in a virtual environment without much light?
2) How well do people estimate the colors from a view in the virtual environment with bright light?
3) How well can people estimate the colors of objects placed around a light in a virtual environment?

2. Experimental Design

In this section, a virtual environment is described in the beginning before turning to different experiments. The experiments are tested three situations: very little light, a bright light and many objects in a room with a light.

Environment Description

The room is set up with several objects such as cubes and pyramids with the color being gray. The floor and the wall have the same color (gray) without any texture. In addition, the height of the room should be similar to the room which the users stand in. The objects (cubes, spheres, pyramids, and cylinder) will have different textures in different experiments. The users or tester do not have any knowledge about these textures before. The room is kept in between different experiments, whereas the objects in the room are changed with different purposes.

Tests protocol

During the experiment, English is the main language in order to instruct the test participants. To start the experiment, the users or test participants are required to carefully read the description of the experiment and also sign on several agreements.
Due to the variety of color perception, [1] separates color perception into three dimensions (hue, lightness, and saturation). In addition, the hue is indicated as the most utilization in previous experiments and stimuli [2]. In this hypothesis, the lightness is considered as the main category. Therefore, a short description of lightness is introduced to the test participants. Then, the participant is asked to select and identify 10 different tones of colors. Before wearing the HTC Vive headset, the test participant has the Interpupillary distance (IPD) taken to set the headset.

First experiment

Once entering the room (VR environment), the test participant will see a cube. Then, there is a question: “Can you estimate each with a number from 0 to 10 as the tones of color to sides of the cube?”. After that, the cube is replaced by a pyramid at the same place. The test participant is asked he same question before moving to the next scene.

Second experiment

In the second scene a light is added to the left of the room. Then, with the same cube as the first scene, the participant is asked “Can you give numbers from 0 to 10 as tones of color to sides of the cube?”. The question is repeated with the pyramid replacing the cube before moving to the third experiment.

Third experiment

This experiment is set up similar to the second scene; however, there are four cubes instead of a cube in the beginning. These cubes are put around the light which is in the middle of the room. The same question is again asked “Can you estimate the tones of color for different sides of cubes in the room?”. Afterwards a cube is shown with the correct tones of color without effects of the lighting. A question is asked that “Do you now want to change your answer with the other cubes?”. This experiment is repeated again with pyramids.

After answering these questions, the test participant can take off the headset and is asked to answer a few more extra-questions:

- Do you have color vision deficiency of any type?
- Have you ever used VR before? If yes, how often or how many times have you tried?
- How did you estimate the different tones of color in the scenes?
- Do you think the tones of color in the VR are different from the real life?
- Would you answer the same in an experiment in a real environment?

The test participant can leave the test room and is reminded that the participant should not share their experiment to other test participants.

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References

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[2] Debi Roberson and Jules Davidoff. The categorical perception of colors and facial expressions: The effect of verbal interference. Memory & Cognition, 28(6):977–986, 2000.