Course: VR Systems and Humans - 521149S
Assignment IV.3 - Report from The Rat Lab

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1 Hypothesis for Color Perception

Test questions:

> How well do people estimate the colors and the shadow of objects from a room in the virtual environment without the light?
>
> How well do people estimate the colors from a view in the virtual environment with the light?
>
> How well do people can estimate the colors of objects placed around a light in the 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: no light, having a light and many objects in a light room.

2.1 Environment Description

The room is set up with only several objects such as cubes and pyramids with the color being gray. The floor and the wall have the same color (the 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 from these textures before. The room is kept in different experiments, whereas the objects in the room are changed with different purposes.

2.2 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, he/she is asked to select and identify 10 different tones of colors. Before wearing the HTC Vive headset, the test participant is taken Interpupillary distance (IPD) to set the headset.

2.3 First experiment

Once entering the room (VR environment), the test participant will see a cube. Then, there is a question: " Can you estimate each 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 with the same question above before moving to the next scene.

2.4 Second experiment

In the second scene, the test participant is noticed that there is a light at the left of the room. Then, with the same cube as the first scene, he/she 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.

2.4.1 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 still asked "Can you estimate the tones of color for different sides of cubes in the room?". Then, a cube appears as the correct tones of color. A question is that "Now, do you want to change your idea again?". This experiment is repeated again with pyramids.

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

- 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?

- Will you answer the same in the real experiment?

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

References

[1] Emre Özgen and Ian RL Davies. Acquisition of categorical color perception: a perceptual learning approach to the linguistic relativity hypothesis. *Journal of experimental psychology: general*, 131(4):477, 2002.

[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.