SWE3053: Human Computer Interaction
Semester 2, 2021

Assignment #8: Inferential Statistics

[28% of Total Assignment Score]

Objective: In this assignment, you will apply inferential statistical analysis to draw conclusions based on data collected from an experiment.

THE EXPERIMENT

General Research Question
Does AR improve human performance in assembly tasks relative to other media?

Methodology
A between-subjects experiment was conducted. There was one independent variable, the class of instructional media used, with four levels: a printed manual (treatment 1), CAI on a Liquid Crystal Display (LCD) monitor (treatment 2), CAI on a see-through HMD (treatment 3), and spatially registered AR (treatment 4). The dependent variables included time of completion of the task, error rates, and perceived mental workload.

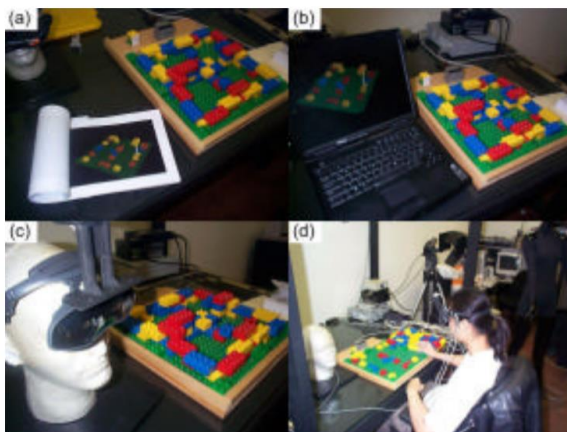The four treatment conditions are illustrated as follow:

Figure 2. Experimental setups: (a) Treatment 1: printed media, (b) Treatment 2: CAI on LCD, (c) Treatment 3 and 4: CAI on HMD and AR, (d) experiment in action. position and orientation of the screen.
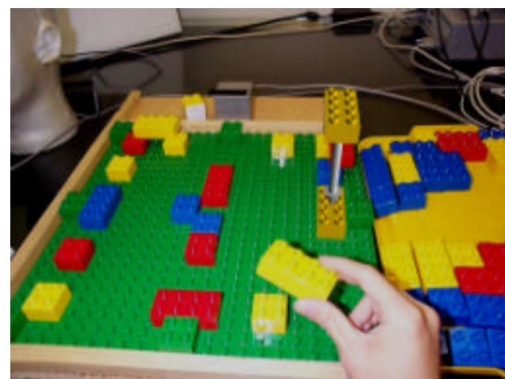

Figure 3. Illustration of the views inside the see-through HMD in treatment condition 4.

Participants
80 participants from an introductory undergraduate class at a university volunteered to participate in the study for class credit. Because gender is correlated with spatial

ability, participants were first approximately stratified by gender (so that each treatment condition has equal number of male and female participants) to control possibly gender effects.

<u>Experimental Task</u>
Subjects were required to complete an assembly task according to the instructions presented using the specific medium as per the appropriate treatment. An assembly task based on Duplo blocks was used in the experiment to minimize bias towards a population with expertise in a certain knowledge related to an assembly task, and for task generalization so the result is applicable to general assembly tasks rather than assembly tasks in specific domains.

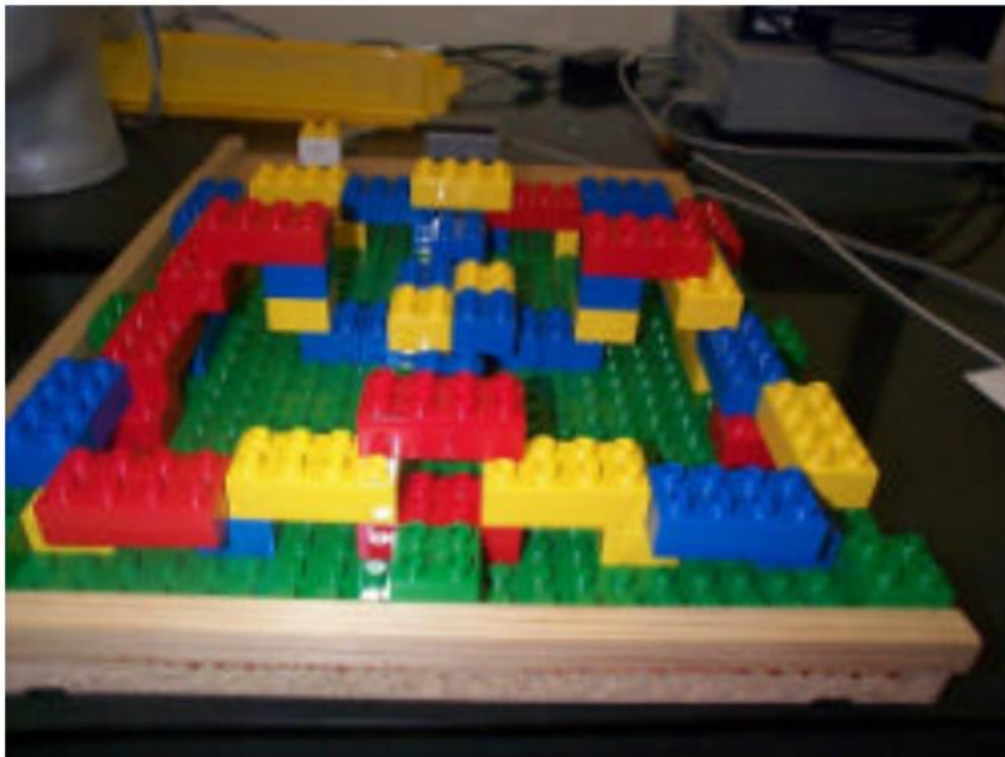The experimental task is illustrated as follow:

Figure 1. The completed assembly task.

Measurements
4 measurements were taken from each subject:
  1. The time of completion for the task;
  2. The number of error made in the task; and
  3. Users' perceived mental workload (measured by NASA Task Load Index (TLX), a paper based post-test measurement). The measurement is in the scale of 1-10, 1 being least mental workload, and 10 being most mental workload.

4. After the completed the task, they were asked to try all 4 interfaces, and select they choice of preference.

Experimental Data

The experimental data is in the Excel sheet attached.

You must use the data in this excel sheet to perform your analysis. If you use other data for your analysis, you work will not be graded and you will receive a **<u>zero</u>** for your work.

Questions

A. Effect of type of interface to time of completion
1. State the Null Hypothesis and Alternative Hypothesis.
2. What is the statistical method to analysis the Hypothesis?
3. Select a level of significance.
4. Calculate your statistics in PSPP (or other software of your choice).
5. What conclusion can you make based on your statistical analysis?

B. Effect of type of interface to error rate
1. State the Null Hypothesis and Alternative Hypothesis.
2. What is the statistical method to analysis the Hypothesis?
3. Select a level of significance.
4. Calculate your statistics in PSPP (or other software of your choice).
5. What conclusion can you make based on your statistical analysis?

C. Effect of type of interface to perceived mental workload
1. State the Null Hypothesis and Alternative Hypothesis.
2. What is the statistical method to analysis the Hypothesis?
3. Select a level of significance.
4. Calculate your statistics in PSPP (or other software of your choice).
5. What conclusion can you make based on your statistical analysis?

D. User's preference of interface
1. State the Null Hypothesis and Alternative Hypothesis.
2. What is the statistical method to analysis the Hypothesis?
3. Select a level of significance.
4. Calculate your statistics in PSPP (or other software of your choice).
5. What conclusion can you make based on your statistical analysis?

- *You should attach the results generated from PSPP (or other analytical software) in the solution you submit (i.e. the result tables).*
- *You should also submit the file you used (i.e. the PSPP file) in your analysis.*