1. **Project Title**: Factors influencing video game frame rate.

**Background Information**: Choreography, music, sculpture, painting, architecture, literature, drama and film are commonly called The Eight Arts, and today many people argue that combined with video games, there will be nine of them. Many moving stories and happiness are told through this form, but the gaming experience varies greatly depending on your hardware configurations. We are interested in the factors that influence video game frame rate, and we think that the hardware and its configurations impact the game’s frame rate. Therefore, we will test multiple similar games for their average frame rates with different hardware and configurations.

1. **The experimental unit(s):** Games
2. **Factors**: (Qualitative, Independent)GPU types, (Quantitative, Independent) CPU frequency
3. **Levels:**

(Qualitative, Independent) GPU Type: GTX1060, MSI RTX3060ti

(Quantitative, Independent) CPU Frequency: 3.2 GHz, 3.7 GHz, 4.2 GHz

1. **Response Variable:** Average Frame rate (Quantitative, dependent).

1. **Treatments:** GTX1060, CPU@3.2GHz; GTX1060, CPU@3.7GHz; GTX1060, CPU@4.2GHz; RTX3060ti, CPU@3.2GHz; RTX3060ti, CPU@3.7GHz; RTX3060ti, CPU@4.2GHz;
2. **Four Principles:**

**Control**: Running the game with the same internet, same computer, same monitor, same GPU manufacturer and same CPU.

**Blocking**: We categorize the games’ minimum requirements into: High-end games group; Low-end games group

**Randomization:** We will use Randomized Block Design. Within each block, we randomly assign each experimental unit to different treatment groups.

**Replication:** We run a game in each treatment 3 times.

1. **Confounding variables:** The condition of the hardwares.(Mainly caused by cleanliness and manufacturing tolerances)

**Mitigate methods:** We clean the hardware before we conduct the experiments.

Quantitative

1. **Control Group**: We set a base group where we run the experiments with default settings.
2. **Reason that we do not include placebo treatment, blinding, double-blinding:**

This experiment is conducted using personal computers (machines), they do have psychological feelings.

1. **Total Observations:** 36
2. **Methods:**

To be able to obtain the average frame rate data and more control, we will run the experiment through the game’s built-in benchmarks. These benchmarks provide essential data(average frame rate, GPU usage and so on), and fixes the environment (the benchmark sets the length of each gameplay to be exactly the same, sets the map we load to be the same and makes each benchmark run under the same conditions for the same game).

1. **GLM**

We will use generalized linear models to explore the effect of each factor on average FPS.

1. **Two-way ANOVA**

We will use Two-way ANOVA for our research since we have two factors in our experiment.