Ismail Akram
ENGL 210
Prof. Stephen Conway

Quantifying the Performance of a GTX1070ti Graphics Card on A Range of Games.

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Abstract

In order to display high quality images and video from a personal computer (PC), a Graphics Processing Unit (GPU) is required. Video games are the ideal applications to test for video and images because they can range from having conservative to taxing demands for the GPU. The ASUS ROG Strix GTX 1070ti GPU was selected to account for the range of games tested. The "frames per second" (FPS) was the key variable sought from each game while PC hardware and resolution remained constant. The results convey a correlation between high FPS with low detailed games, and lower FPS with high detailed games.

Introduction

GPUs render images of a video (or image) individually as a frame/picture. A game requires a computationally powerful GPU to output abundant frames in real-time. This is especially true for highly detailed games running at higher resolutions. Games with simple graphics such as Minecraft would require much less computational power than Mirror's Edge, which depicts photorealistic graphics. The goal of the experiment is to measure the FPS outputs from these taxing applications and compare their differences.

Objective

This experiment documents the FPS output from ten game while maintaining a 1440p resolution with the highest settings. The games selected range from conservatively demanding to taxing. Since FPS can fluctuate depending on in-game circumstances, it is essential to record an average FPS. This is done by noting the lowest and highest FPS from static and dynamic gameplay activity.

Materials

While the GPU, Central Processing Unit (CPU) and Random-Access Memory (RAM) are the core components, other variables can affect framerate output. Therefore, I am outlining every component used for my PC as well as the monitor.

PC setup with the following components [1]:

- GPU: ASUS ROG Strix GTX 1070ti
- CPU: AMD Ryzen 7 2700x
- RAM: G. Skill Trident Z 16GB DDR4-3200
- Corsair H100i PRO 75 CFM Liquid Cooler
- MSI X470 GAMING PLUS ATX AM4 Motherboard
- Samsung 860 Evo 1 TB 2.5" Solid State Drive
- EVGA SuperNOVA G3 750 W 80+ Gold Power Supply,
- Asus ROG SWIFT PG278QR Monitor
- Windows 10 OS

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10 games to quantify performance:

- Minecraft
- Overwatch
- Destiny 2,
- Mirror's Edge Catalyst
- DMVC
- Control
- Dark Souls 3
- Nier Automata
- Sekiro
- Tekken 7

Procedure

1. Turn on PC setup with Windows 10 OS and the 10 listed games (see materials) installed.
2. Boot up first game to test and simply note the FPS (usually 60 FPS on the top right of the screen) at the main menu of the game is constant. This is to ensure the game is running properly.
3. Start a "New Game" for the game and locate any static environment and document FPS displayed. This is your highest FPS.
4. Experiment inside the game environment by manipulating the physics and particles in game while generating as much movement as possible, note down the FPS displayed. This will be your lowest FPS.
5. You now have your highest and lowest FPS recorded.
6. Calculate the average FPS by dividing the sum of the highest and lowest FPS by 2.
7. Repeat steps 2-6 for each game and record.
8. Chart results in a table and graph (see table 1, figure 1 and figure 2).

Results

Table 1. Highest, lowest, and average FPS of each game.

Game @ 1440p "Ultra"	Highest FPS	Lowest FPS	Average FPS
Minecraft	360	380	370
Overwatch	120	130	125
Destiny 2	80	100	90
Mirror's Edge	68	84	76
DMCV	65	81	73
Control*	59	63	61
Dark Souls 3	60	60	60
Nier Automata	60	60	60
Sekiro	60	60	60
Tekken 7	60	60	60

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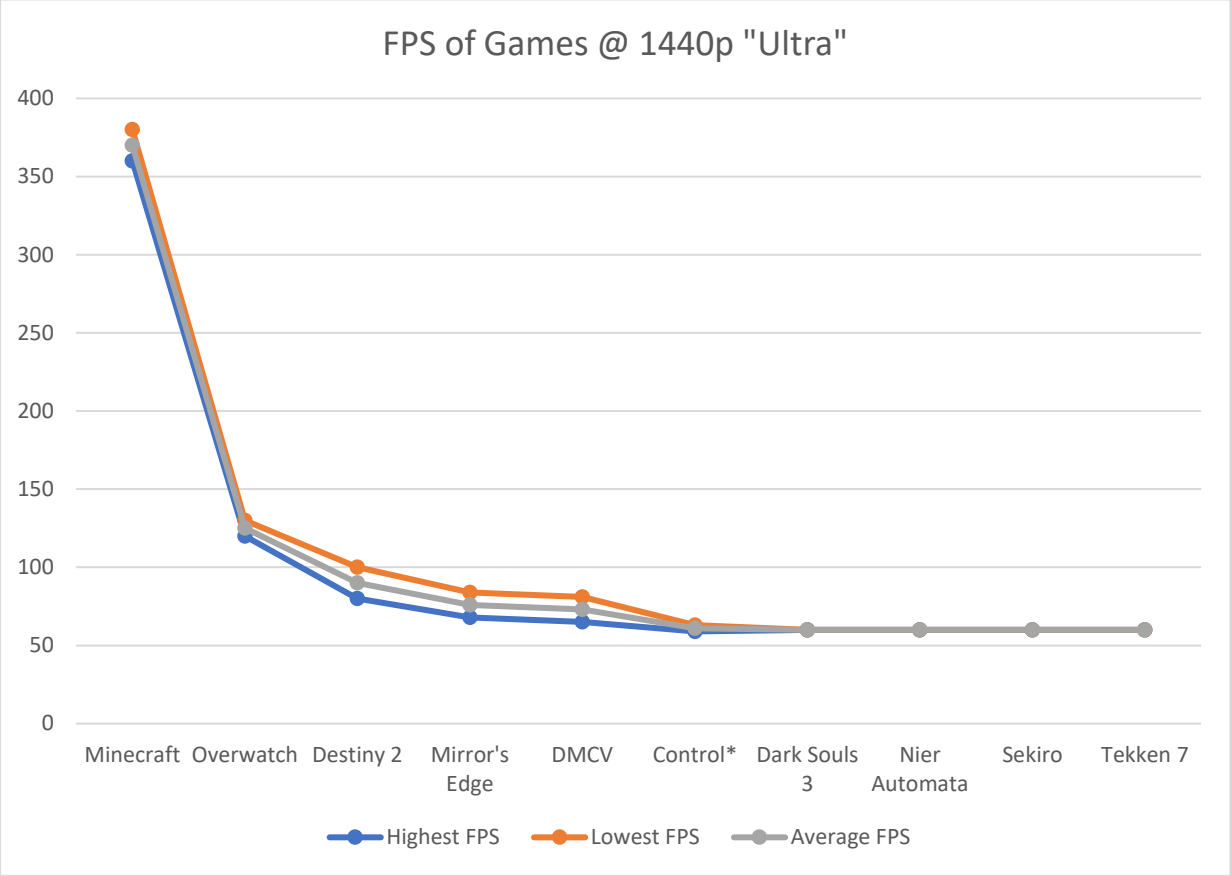

Figure 1. Line graph of highest, lowest, and average FPS of each game.

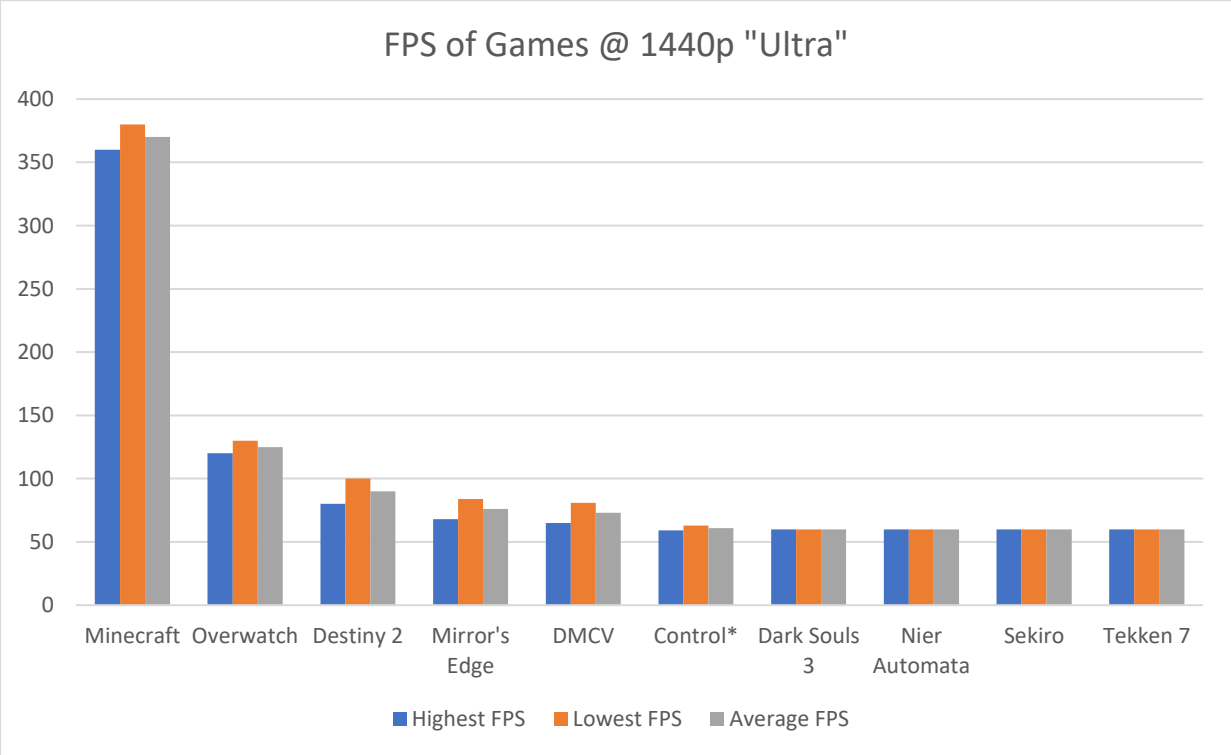

Figure 2. Column of highest, lowest, and average FPS of each game.

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Analysis

Since the framerate fluctuates in gameplay, it is essential to calculate the average between highest and lowest FPS. It is worthwhile to note that certain games have a limit on maximum framerate due to developer intentions. It is also worthwhile to note that framerate is greatly affected by number of moving parts within the screen. As such, static environments will generally output a higher FPS than one with many moving particles. Therefore, we needed to record a highest and lowest FPS.

Overall, one can confidently conclude that a game with a lower complexity of detail (Minecraft and Overwatch) will output a higher FPS than more complex and detailed games (Mirror's Edge Catalyst and so on). The Strix GTX 1070ti's output constitutes it as a high-end graphics card. The extreme FPS of Minecraft and Overwatch and consistent, high FPS of the rest reflect this conclusion.

Figure 3. In-game screen capture of Minecraft (average FPS: 370)

Figure 4. In-game screen capture of Mirror's Edge Catalyst (average FPS: 60)

Reference List

[1] "System Builder." *PCPartPicker*, 2019. Accessed October 12, 2019.

https://pcpartpicker.com/list/vLbXHB