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# Video Game Performance Data: Summarizing with Statistics and Graphs

Based on Serious Statistics Reprocessed: Statistics and Scripts

Jim Pitchford

November 5, 2019



Presentation and Article

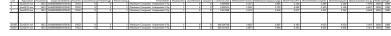
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## Data

# Problem:

Summarizing Data in Representative Way



• Video game performance measurements can result in rather large recordings

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## Problem:

## Summarizing Data in Representative Way



 Video game performance measurements can result in rather large recordings

L	ine	Application	 TimeInSeconds	MsBetweenPresents	MsBetweenDisplayChange	MsInPresentAPI	MsUntilRenderComplete	MsUntilDisplayed	MsEstimatedDriverLag	Width	Height
1		Sam2017.exe	0.005609	4.257	3.884	0.166	3.284	3.284	7.446	1920	1080
2		Sam2017.exe	0.009513	3.904	3.729	0.080	3.109	3.109	6.847	1920	1080
3		Sam2017.exe	0.012988	3.475	3.628	0.072	3.262	3.262	6.658	1920	1080
-											
		Sam2017.exe	 300.306738	3.682	3.687	0.362	4.023	4.023	7.343	1920	1080
8	1357	Sam2017.exe	300.310425	3.687	3.690	0.363	4.026	4.026	7.351	1920	1080

- Even after ignoring developer-oriented data, there can still be a lot
- Clear statistics and graphs to provide representative summaries of data are necessary

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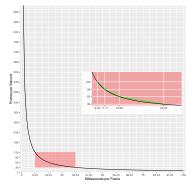
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## Problem: FPS vs milliseconds

How you measure the data and the units the statistics are in also matter



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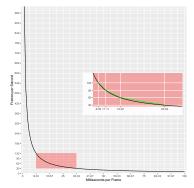
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## Problem: FPS vs milliseconds

How you measure the data and the units the statistics are in also matter



- FPS is a non-linear measurement but clear
- milliseconds is linear but not as clear

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## Problem: Which Statistics

Average is an ambiguous term, but can assume **Arithmetic Mean:** 

$$\sum_{n} \frac{x_n}{n}$$

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## Problem: Which Statistics

Average is an ambiguous term, but can assume **Arithmetic Mean:** 

$$\sum_{n=1}^{\infty} \frac{x_n}{n}$$

Average is the expected value or central tendency of a distributionm like the

Median:

$$x_1 \dots x_{n/2} \dots x_n$$
 or  $x_1 \dots \frac{x_{n/2-1} + x_{n/2+1}}{2} \dots x_n$ 

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## Problem: Which Statistics

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Median:

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 or  $x_1 \dots \frac{x_{n/2-1} + x_{n/2+1}}{2} \dots x_n$ 

Geometric Mean:

$$\prod_{n=1}^{n} \sqrt[n]{x_n} \quad \text{or} \quad e^{\overline{\log(x)}}$$

Advantages and disadvantages make it context sensitive

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## Problem: Which Statistics

Central tendencies may or may not be sensitive to outliers Performance bounds are also useful information

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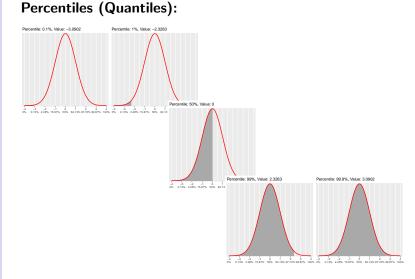
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## Problem: Which Statistics

Central tendencies may or may not be sensitive to outliers
Performance bounds are also useful information

Percentiles (Overtiles):



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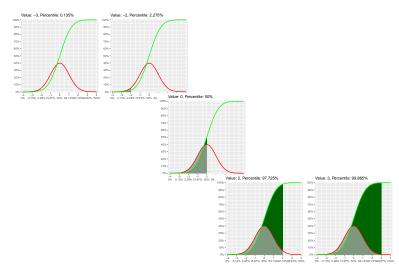
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Statistics

## Problem: Which Statistics

Reverse: Finding the bound for a value

## **Empirical Cummulative Distribution Function (ECDF):**



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Results

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# Results:

## Serious Sam Fusion 2017 - DirectX 11

GPU	Location		Mean	Median	0.1%	1%	99%	99.9%	60 FPS
RX Vega 64	Hatsheput	FPS	270.91	267.52	393.65	365.5	226.55	209.9	0
RTX 2060	Hatsheput	FPS	226.67	226.09	303.57	288.18	180.34	172.21	0
RX Vega 64	Hatsheput	ms	3.69	3.74	2.54	2.74	4.41	4.76	0
RTX 2060	Hatsheput	ms	4.41	4.42	3.29	3.47	5.54	5.81	0

Video Game Performance Data: Summarizing

Summarizing with Statistics and Graphs

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### Examples

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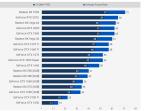
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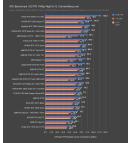
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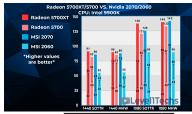
Reference

# Example Graphs:











### Sources:

<ul><li>Techspot/Hardware Unboxed</li></ul>	●Level1Techs		
Gamers Nexus	●Phoronix		

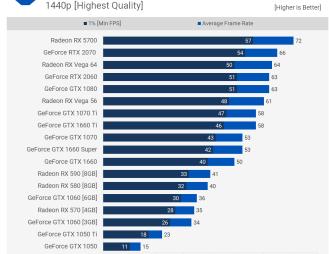
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## Examples

# Example Graph - Techspot/Hardware Unboxed



# Shadow of the Tomb Raider [DX12]



NVIDIA GeForce GTX 1660 Super Review

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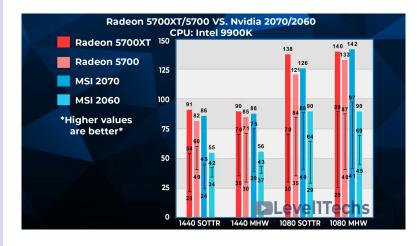
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# Example Graph - Level1Techs



Radeon 5700 & 5700XT Launch Coverage & Testing

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### Examples

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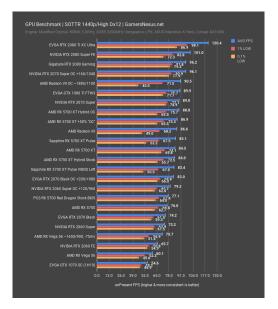
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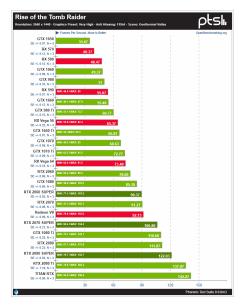
## Example Graph - Gamers Nexus



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## Examples

# Example Graph - Phoronix



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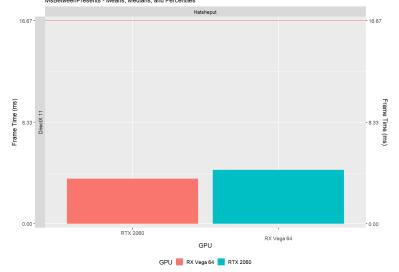
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## Means

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - Means, Medians, and Percentiles



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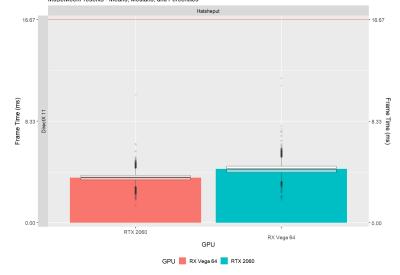
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## Means

Means and

# Means, Medians, and Quartiles

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - Means, Medians, and Percentiles



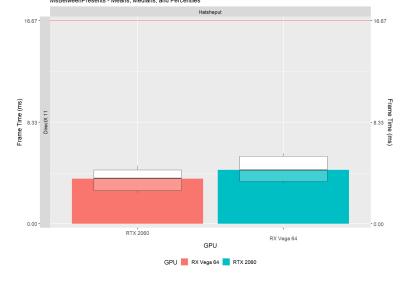
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Means

# Means, Medians, and Percentiles

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - Means, Medians, and Percentiles



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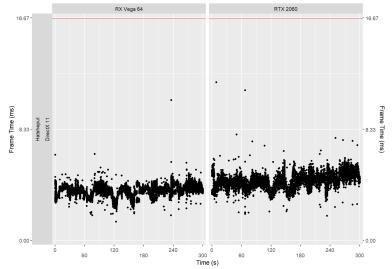
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## Course

Serious Statistics Reprocessed - Max Quality





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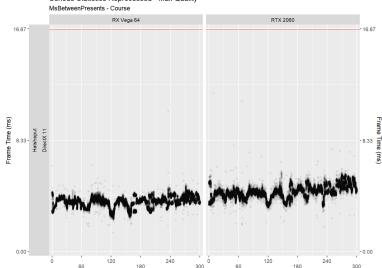
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# Course and Density

Serious Statistics Reprocessed - Max Quality



Time (s)

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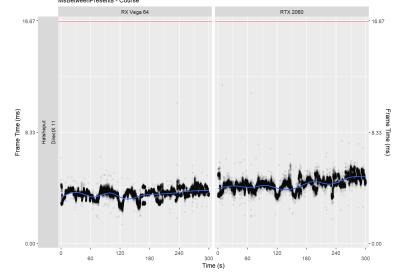
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# Course, Density, Smooth

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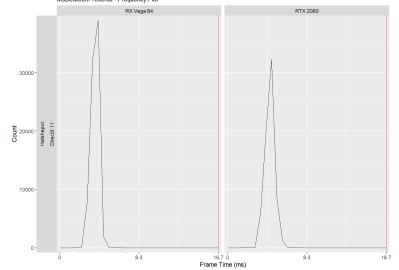
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# Frequency

Serious Statistics Reprocessed - Max Quality
MsBetweenPresents - Frequency Plot



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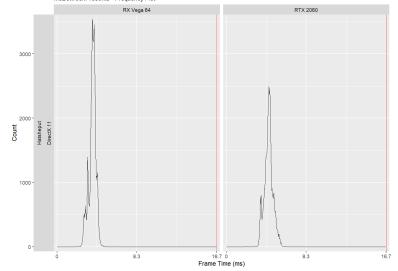
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Frequency

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# Frequency and Thin Bins

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - Frequency Plot



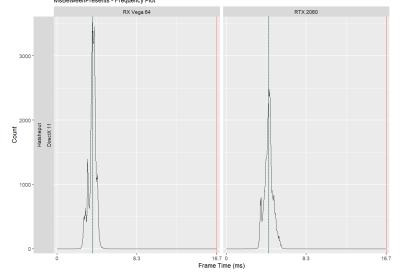
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## Frequency

# Frequency, Thin Bins, and Statistics

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - Frequency Plot



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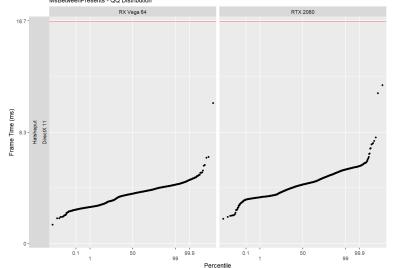
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## Quantiles

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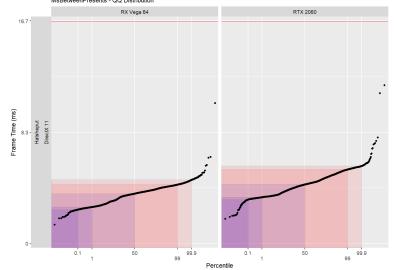
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## Quantiles

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## Quantiles and Guides

Serious Statistics Reprocessed - Max Quality MsBetweenPresents - QQ Distribution



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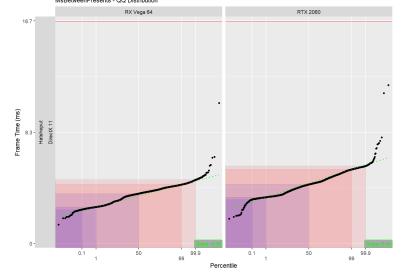
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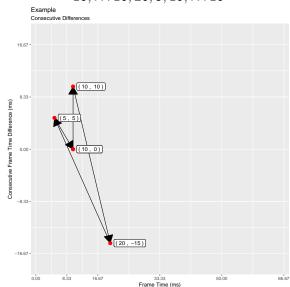
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References

# Consecutive Difference - Example

 $10, \dots 10, 20, 5, 10, \dots 10$ 



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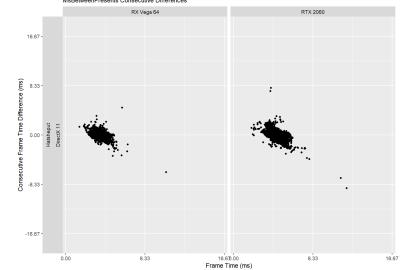
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References

## Consecutive Difference

Serious Statistics Reprocessed - Max Quality
MsBetweenPresents Consecutive Differences



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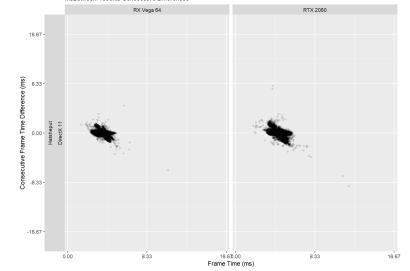
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Consecutive Difference

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# Consecutive Difference and Density

Serious Statistics Reprocessed - Max Quality MsBetweenPresents Consecutive Differences



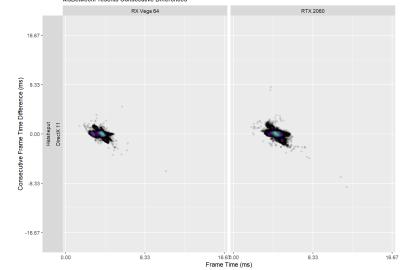
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### Consecutive Difference

# Consecutive Difference, Density, and Heatmap

Serious Statistics Reprocessed - Max Quality MsBetweenPresents Consecutive Differences



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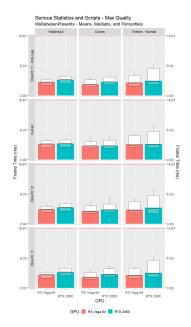
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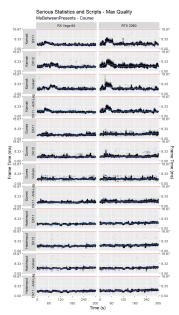
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# Means, Medians, and Percentiles - Course





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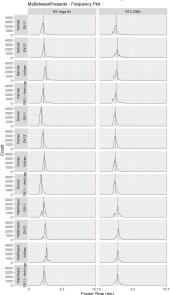
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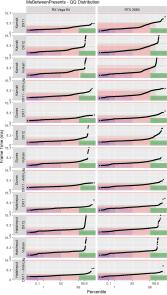
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# Frequency and Quantile





### Serious Statistics and Scripts - Max Quality MsBetweenPresents - QQ Distribution



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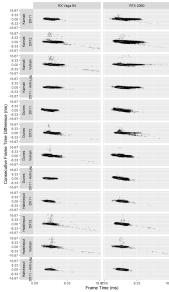
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References

## Consecutive Difference





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References

## References:

Example Graphs can be found at:

- Techspot/Hardware Unboxed NVIDIA GeForce GTX 1660 Super Review
- Level1Techs Radeon 5700 & 5700XT Launch Coverage & Testing
- Gamers Nexus PowerColor RX 5700 Red Dragon Review: First of the Partners
- Phoronix NVIDIA RTX 2060 / 2070 / 2080 SUPER Linux Gaming Performance

Original Serious Statistics Reprocessed: Statistics and Scripts can be found on GitHub All data, statistics, graphs, and scripts are in the repository



github.com/GuestJim/Serious-Statistics-Reprocessed